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LETTING GO OF STABILITY: RESILIENCE AND ENVIRONMENTAL LAW

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Historic variation in the environment once served as a reliable guide to future behavior. Sustainability promised continuity of ecological and social structures and functions within the known envelope of historic variation. Now climate change and other environmental stressors are tipping systems into behaviors that no longer remain within the confines of precedent. Social-ecological systems are neither persistent nor predicable. Letting go of stability releases us from untenable expectations of steady maintenance of some natural order. Resistance to change will continue to play a role as environmental law suppresses disruptions and buys time. But resistance will eventually yield the stage to recovery and transformation. Recovery seeks to restore some social-ecological services after a disturbance. Transformation reorganizes systems entirely. Resilience provides a better framework than sustainability for considering the relative merits of these management approaches. Managing resilience as an environmental law objective will promise less but deliver more of what it promises. Environmental law is for people —provisioning their wants and resolving their disputes. Viewing it as a nested set of social-ecological systems gets us away from dualist notions of nature versus society that seldom help the environmentalist cause. Precaution will remain a defining attribute of environmental law, but it cannot promise certainty. Static law will yield to experimentation and moral imperatives for change. Resilient environmental law will need to be attentive to social, as well as ecological, transformations. It will clarify for citizens how they benefit from environmental law. This Article synthesizes and assesses the legal scholarship on resilience. It suggests productive paths for law reform and more equitable tools for weighing consequences of natural resource management. Environmental law research in the coming years should explore specific, place-based approaches to managing resilience and safe-fail designs for adaptive governance.

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INTRODUCTION

Anglo-American law has always resisted the unpredictability of nature. Law facilitates modifications to the environment in order to create more favorable conditions for reliable transportation, pollution abatement, and supplies of food and energy. People alter the environment and then want the change to stick. The environment pushes back and disrupts expectations of stability.

At one time, a comforting balance-of-nature paradigm promised continued, steady ecological services.[1] After learning that ecosystems do not conform to that notion, sustainability seemed to offer a path to continue legal objectives of stability.[2] Today, disruptive shifts in society and environmental conditions pose challenges for environmental law as guarantor of stability. Much environmental law, especially in the pollution control branch, seeks to avoid and remediate damage done to the environment. Conservation legislation often promises that the last, best, untouched, intact, or untainted places will be preserved. Both branches of environmental law ultimately envision a final environmental condition that achieves social objectives and then *maintains* them. Though all generations observe environmental variability, the changes we observe today are qualitatively different, accelerating at historically unprecedented rates, and unravelling ecosystems. We need new organizing principles to reconcile social demands with ever-more dynamic natural systems.

Over the past several years, the concept of resilience has gained currency in conservation circles for understanding our world.[3] As an organizing framework,

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1. DANIEL B. BOTKIN, DISCORDANT HARMONIES: A NEW ECOLOGY FOR THE TWENTY-FIRST CENTURY 6–13 (1990); Fred P. Bosselman & A. Dan Tarlock, *The Influence of Ecological Science on American Law: An Introduction*, 69 CHI-KENT L. REV. 847, 855 (1994).

2. *See, e.g.*, Reed F. Noss, *Some Principles of Conservation Biology, as They Apply to Environmental Law*, 69 CHI-KENT L. REV. 893, 894–95 (1994) (arguing that the unpredictability and disequilibrium of nature requires a legal response that prioritizes sustaining the large landscapes); Julianne Lutz Newton & Eric T. Freyfogle, *Sustainability: A Dissent*, 19 CONSERVATION BIOLOGY 23, 28 (2005) (tracing the roots of sustainability objectives and highlighting the challenges of applying it to ecological systems).

3. *See generally* MELINDA HARM BENSON & ROBIN KUNDIS CRAIG, THE END OF

resilience offers the promise of improving decisions about pollution, resource extraction, and environmental management. The property of resilience observed in social-ecological systems does explain much of what we observe. As such, it is an essential consideration in devising realistic priorities for what we would like environmental law to achieve.

The ecologist Buzz Holling's seminal article defined resilience as the ability of a system to absorb changes yet still persist.[4] For law and other systems that include people, resilience describes the continuity of relationships within a system. Resilience "is a measure of the ability of these systems to absorb changes" yet still provide the same function, structure, and identity.[5] The dynamic system "human-bike" illustrates the concept of resilience.[6] This system has two equilibrium states: (1) the standard forward motion while riding the bike and (2) flat on the ground, stationary. From the position of the first state, suppose the rider hits a bump. The bike starts to wobble. If the wobble attenuates and steady forward motion resumes, then the resilience of the system absorbed the disturbance and returned to the prior state. Even if the forward motion does not resume in exactly the same manner, say because the bump bent the tire in a minor fashion, the system is in a forward motion state but may not be as productive. In that case, the bump modified the system. But the system retains its function, structure, and identity. If the wobble amplifies and the bike crashes to the ground, then the disturbance triggered a change into a different equilibrium state. The greater the bump the system can absorb without causing the rider to fall, the greater the resilience of the human-bike forward-motion state.

The social-ecological systems resilience literature explores how large an exogenous shock—the bump in the road—the system can endure and recover its original equilibrium. It is also about the other equilibria that the system might transform into if subject to a great enough disturbance. The disturbance may be a human intervention, such as a species introduction or overfishing. Or, it may be a hurricane or an epidemic. Some systems may have more than two stable states.[7]

SUSTAINABILITY: RESILIENCE AND THE FUTURE OF ENVIRONMENTAL GOVERNANCE IN THE ANTHROPOCENE (2017); Tracy-Lynn Humby, *Law and Resilience: Mapping the Literature*, 4 SEATTLE J. ENVTL. L. 85 (2014).

4. C.S. Holling, *Resilience and Stability of Ecological Systems*, 4 ANN. REV. ECOLOGICAL SYS. 1, 17 (1973).

5. Marco A. Janssen & Elinor Ostrom, *Resilience, Vulnerability, and Adaptation: A Cross-Cutting Theme of the International Human Dimensions Programme on Environmental Change*, 16 GLOBAL ENVTL. CHANGE 237, 237 (2006); *see also* Brian Walker, Lance Gunderson, Ann Kinzig, Carl Folke, Steve Carpenter & Lisen Schultz, *A Handful of Heuristics and Some Propositions for Understanding Resilience in Social-Ecological Systems*, 11 ECOLOGY & SOC'Y, no. 1, 2006.

6. Thanks to Professor Kerry Krutilla, who described this riding-a-bike analogy to me. He and Rafael Reuveny have explored economic approaches to modeling resilience. *E.g.*, Kerry Krutilla & Rafael Reuveny, *The Systems Dynamics of Endogenous Population Growth in a Renewable Resource-Based Growth Model*, 56 ECOLOGICAL ECON. 256 (2006); Kerry Krutilla & Rafael Reuveny, *The Quality of Life in the Dynamics of Economic Development*, 7 ENV'T & DEV. ECON. 23 (2002).

7. Donald Ludwig, Brian Walker & Crawford S. Holling, *Sustainability, Stability, and Resilience*, 1 ECOLOGY & SOC'Y, no. 1, 1997.

Professor Holling promoted resilience as a way of understanding complex ecological systems in 1973. Over the past quarter century, advances in resilience research also applied the idea to the human behaviors and institutions that link to changes in ecological functioning through a social-ecological systems framework. But only in the past decade have legal scholars debated resilience's significance for environmental law. The resilience concept speaks to a yearning in the field of environmental law for an organizing principle. And it describes how adaptation to climate change may sometimes alter our environment and society while still retaining essential functions, structures, and identity. Other times, adaptation may not succeed in sustaining the current state of our social-ecological systems.[8] Resilience objectives upset longstanding expectations of stability and predictability.[9] Reforms to law itself, aside from the objectives environmental law seeks to achieve, may also benefit from insights that emerge from resilient systems research. This Article reckons with all these implications of resilience for environmental law.

Part I discusses environmental law and revives an old debate about whether the field revolves around a central, organizing principle. Part II describes how the resilience framework can improve environmental management. Resilience, fundamentally, is an emergent property of systems, not a normative theory.[10] To employ resilience in setting environmental goals, we must pour social and ethical content into it. In other words, resilience gets us nowhere without deciding resilience *of what, to what,* and *for whom.* Such devilish details arise in any framework we choose. A new paradigm sounds momentous but may instead be only so much rearranging of deck chairs.

If resilience will prompt a different way of governing our disputes over the environment, it must respond to a key question addressed in Part III: Can resilience provide what people demand of environmental law? Stability and predictability are often at the core of our interests with respect to the environment.[11] For pollution, we want ecosystems to absorb and detoxify contaminants, as rivers do for much of what we discharge. For natural resource conservation, we want a steady flow of food, fiber, energy, minerals, and environmental services, such as flood control. Sustainability promised all that.[12] Resilience recognizes that the environment does not always respond the way we desire or forecast.[13] Ecosystems that have historically delivered in a predictable fashion are increasingly failing to meet our expectations.[14] We must therefore reshape those expectations and the systems that govern how we manage the environment.

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8. This is one reason why climate-change mitigation through reduction and removal of greenhouse gases from the atmosphere is important.

9. Melinda Harm Benson, *Reconceptualizing Environmental Challenges—Is Resilience the New Narrative?*, 21 J. ENVTL. & SUSTAINABILITY L. 99, 116 (2015); J.B. Ruhl, *General Design Principles for Resilience and Adaptive Capacity in Legal Systems—With Applications to Climate Change Adaptation*, 89 N.C. L. REV. 1373, 1374, 1386 (2011) (discussing stability and predictability, respectively).

10. Ruhl, *supra* note 9, at 1394–95.

11. *See* Benson, *supra* note 9, at 125.

12. BENSON & CRAIG, *supra* note 3, at 2–3.

13. *See id.* at 116.

14. *See id.* at 118–19.

Even if resilience does provide a superior framework for setting goals, we must consider whether the design of environmental law itself needs to be more resilient. Part IV considers whether doctrines, statutes, and regulations themselves need to be resilient in order to promote resilient social-ecological systems (SES). Law reform enhancing resilience of statutory and administrative activities must create a better framework for the moral calculus of justice and participation. It also must operate in a flexible, adaptive manner and provide avenues to work across jurisdictional boundaries.

These sorts of questions have been around for a long time, even predating the reform statutes of the 1970s, when environmental law emerged as a field of study. So, in puzzling through answers, I build upon the work that has come before and focus on how resilience is similar to or different from other ideas adopted and discarded over the past century. Resilience is unlikely to be a flash-in-the-pan. Unlike sustainability, it is a fundamental attribute of the world. It is also deeply embedded in the social objectives of climate-change adaptation.[15] It fundamentally addresses the environment, but its role in environmental *law* is far less clear. This Article proposes a way of thinking about resilience in environmental law rather than a particular set of reforms. Environmental law research in the coming years should consider specific, place-based approaches to the management of resilience and safe-fail designs that produce adaptive governance.

I. DOES ENVIRONMENTAL LAW NEED AN OVERARCHING GOAL?

Modern environmental law grew in the late 1960s and early 70s as Congress awoke to public discontent with the ability of courts and states to safeguard public health and conserve the natural world.[16] Even in its middle age, American environmental law has never completely shaken its inferiority complex as a newcomer to the repertoire of fields in legal scholarship.[17] Is it enough to say that environmental law is about resolving disputes concerning use of public resources? Environmental law seeks to optimize allocation but also to distribute goods and services in an equitable fashion.[18] In doing so, environmental law comprises a hodgepodge of statutes and agency procedures, with a dash of common law property and torts. A survey of statutory, positive environmental law may be no less coherent

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15. BENSON & CRAIG, *supra* note 3, at 4; C.S. Holling & Lance H. Gunderson, *Resilience and Adaptive Cycles*, *in* PANARCHY: UNDERSTANDING TRANSFORMATIONS IN HUMAN AND NATURAL SYSTEMS 25, 27–30 (Lance H. Gunderson & C.S. Holling eds., 2002).

16. *See* RICHARD J. LAZARUS, THE MAKING OF ENVIRONMENTAL LAW 178–79 (2004) (explaining that the technological and economic complexities of pollution control are beyond the institutional competence of courts); Robert V. Percival, *Environmental Federalism: Historical Roots and Contemporary Models*, 54 MD. L. REV. 1141, 1144 (1995) (attributing the rise of federal environmental law to the failure of states to protect their citizens).

17. This perception is belied by the existence of legal decisions concerning air pollution problems for centuries before the emergence of modern environmental law. *See, e.g.*, PETER BRIMBLECOMBE, THE BIG SMOKE: A HISTORY OF AIR POLLUTION IN LONDON SINCE MEDIEVAL TIMES 9–16 (1987).

18. LAZARUS, *supra* note 16, at 24–28.

or structured than the standard property law class.[19] But its relative youth exacerbates the nagging doubts that environmental law is simply a grab bag of problems that share some connection to the environment.[20] If environmental law is nothing beyond a messy compilation of statutes, rules, and cases resolving disputes over competition for natural resources, then it is ultimately an empty vessel. Lawmakers will fill it with the principles of ownership, tortious proximate causation, administrative and civil procedure, as well as statutory interpretation.

Professor Tarlock grappled with the legal content of environmental law when he asked, "Is there a there there?"[21] Tarlock noted the least satisfactory response is simply that environmental law exists, and its content is the "there."[22] Generations of environmental law students can attest that there is no shortage of content to be discovered by diving deep into statutory detail and regulatory morass. But, does that content contribute anything special to the law in order to justify a category of research? A category of law beyond just a subject of legislation requires a special set of principles that cohere. Tarlock worried that the lack of integration of environmental law into the older doctrines of the legal system leaves it "vulnerable to marginalization as support for environmentalism ebbs and flows."[23] Federal environmental law is particularly vulnerable because, unlike the state constitutions, the U.S. Constitution provides weak footing for environmental legislation. In an important sense, the challenge of framing environmental law is little different from other areas of law that emerged from problems beyond the ken of the founders, such as antitrust or labor.[24] To be a distinct field, environmental law needs a framework to resolve disputes in a way that consistently advances a broader goal. Resilience as an overarching theme for environmental law can help resist centrifugal tendencies of an otherwise fragmented collection of statutes and doctrines.[25]

A recent example of how the under-theorized content of environmental law can undermine attempts to improve environmental management is *Michigan v. EPA*.[26] In that 2015 decision, a bare majority of the U.S. Supreme Court found that the agency could not set an emission standard for hazardous air pollutants without considering the cost to the power plants.[27] The Clean Air Act (CAA) requires the EPA to control

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19. *See* James Grimmelmann, *Real + Imaginary = Complex: Toward a Better Property Course*, 66 J. LEGAL EDUC. 930, 935 (2017).

20. A. Dan Tarlock, *Is There a There There in Environmental Law?*, 19 J. LAND USE & ENVTL. L. 213, 215–16 (2004).

21. *Id.*

22. *Id.* at 215–17.

23. *Id.* at 217.

24. *Id.* at 226–28.

25. Public health and welfare are traditional frameworks for deciding on many goals of environmental law, such as setting uniform ambient air pollution standards. 42 U.S.C. § 7409(b) (2012) (defining primary standards for public health and secondary standards for public welfare). But those concepts offer little guidance on the process by which environmental management can deliver on the goals. Recent research, however, connects the effects of climate change to adverse impacts on public health. Jonathan A. Patz & Madeleine C. Thomson, *Climate Change and Health: Moving from Theory to Practice*, 15 PLOS MED., no. 7, 2018.

26. 135 S. Ct. 2699 (2015).

27. *Id.* In reviewing the EPA determination, the Court interpreted a Clean Air Act

certain pollutants if it concludes that "regulation is appropriate and necessary."[28] Relying on the fidelity of environmental law to protecting public health, the EPA emphasized the CAA's goal of avoiding the injuries, morbidity, and mortality "reasonably anticipated to occur" from the emissions.[29] Yet the majority of the Supreme Court applied only the general principles of administrative law and statutory construction in concluding that costs must be a part of the EPA's considerations in order to produce an "appropriate and necessary" rule.[30] If the Supreme Court understood environmental law as a field advancing a central precept of precaution, then one justice may have switched sides and the EPA would not be considering costs in deciding whether to regulate hazardous air pollution, especially mercury, to avoid reasonably anticipated harms to human health. Instead, cost analysis would be deferred to the later step of deciding what kind of emission restrictions should apply to the power plants.

Another problem with a pure positivist response to the question of what is distinctive about the content of environmental law is that it offers little guidance on how to reform statutes and rules. If environmental law is simply the statutes and judicial precedent, then it would seem stubbornly resistant to adapting to new conditions or improved understanding.[31] This positivist view may well explain the current ossification of environmental law legislation, where infrequent amendments generally reflect only a shift in political power rather than adaptation to new circumstances and knowledge.[32]

Depending on how one circumscribes the domain of environmental law, the strongest overarching theme is caution.[33] This essential conservatism of environmental law developed in response to the shortcomings of common law in responding to prospective, probabilistic harms that are often far removed in time and space from multiple, synergetic causes. Building on the work of Professor Sax,[34] Professor Lazarus distilled the essential premise of environmental law as an understanding that "the physical characteristics of the ecosystem generate spatial and temporal spillovers that require restrictions on the private use of natural resources far

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provision relating to power plant emissions that authorizes regulatory controls if the agency "finds such regulation is appropriate and necessary." 42 U.S.C. § 7412(n)(1)(A) (2012).

28. 42 U.S.C. § 7412(n)(1)(A) (2012).

29. *Id.*

30. *Michigan*, 135 S. Ct. at 2707–11.

31. Tarlock, *supra* note 20, at 232.

32. Victor B. Flatt, *Frozen in Time: The Ossification of Environmental Statutory Change and the Theatre of the (Administrative) Absurd*, 24 FORDHAM ENVTL. L. REV. 125, 125–27 (2013). A recent example of an infrequent amendment may be found in the massive Consolidated Appropriations Act of 2018, Pub. L. No. 115-141, Division N—BUILD Act (changing and clarifying federal law governing liability for hazardous waste sites in order to promote redevelopment of abandoned industrial locations).

33. *See, e.g.*, Tennessee Valley Authority v. Hill, 437 U.S. 153, 194 (1978) (interpreting Endangered Species Act as a congressional policy of "institutionalized caution" to avoid extinctions); LAZARUS, *supra* note 16, at 23–24; A. Dan Tarlock, *The Future of Environmental "Rule of Law" Litigation*, 17 PACE ENVTL. L. REV. 237, 239 (2000).

34. *See generally* Joseph L. Sax, *Takings, Private Property and Public Rights*, 81 YALE L.J. 149 (1971).

beyond those contemplated by centuries-old common law tort rules."[35] The same can be said of the social characteristics.[36] Cognizant of the exorbitance or impossibility of reversing environmental injury, environmental law generally takes a preventive rather than a remedial stance, though there are exceptions, notably the Superfund legislation.[37] Lazarus tallied five key attributes: complexity, scientific uncertainty, dynamism, precaution, and controversy.[38] Of those five, the first three relate to the environment itself. Controversy relates to the politics of environmental law. Precaution is the key attribute that defines the law itself.[39]

Conservatism over safety and hesitance to transform ecological systems are relatively new to the "internal logic" of the common law tradition.[40] This may explain the hostility of much of the current political "conservatives" to environmental law. They rouse skepticism of the science and economics that justify wide swaths of environmental regulation.[41] Tarlock claimed that environmental law is revolutionary in that it challenges the settled expectations that remain the primary objective of traditional common law. "Adaptation to changed social conditions are often subordinated to the twin values of stability and predictability."[42] The revolutionary project of redefining harm as long term "risk of future illness or ecosystem malfunction rather than immediate" effects has proven slow to permeate legal institutions outside of those subject to the explicit commands of legislation.[43]

Tarlock ultimately settled on the procedural innovations of environmental law as its greatest contribution to legal thought. Using the National Environmental Policy Act (NEPA)[44] environmental impact analysis requirement as the paradigmatic example, Tarlock found that environmental law is less concerned with consistent outcomes than it is toward fidelity to process.[45] Where science fails to transform legal standards, procedure can bring rationality to bear on specific decisions. Of course, lawyers—by training—love process. Yet, the procedural foundations of environmental law rest upon the crumbling faith in "comprehensive rationality" as a feasible way to account for the effects of activities that impact the environment.

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35. LAZARUS, *supra* note 16, at 121. J.B. Ruhl and James Salzman's *Climate Change, Dead Zones, and Massive Problems in the Administrative State: A Guide for Whittling Away*, 98 CALIF. L. REV. 59 (2010), points out that even statutory solutions often address only small slices of a larger, complex problem with spillover effects.

36. Michael D. McGinnis & Elinor Ostrom, *Social-Ecological System Framework: Initial Changes and Continuing Challenges*, 19 ECOLOGY & SOC'Y, no. 2, 2014.

37. Comprehensive Environmental Response, Compensation and Liability Act, Pub. L. No. 96-510, 94 Stat. 2767 (1980) (codified as amended at 42 U.S.C. §§ 9601–9675).

38. LAZARUS, *supra* note 16, at 16.

39. Precaution is also a core principle of common law torts, though it does not inevitably take the form of a strong precautionary "principle." Robert Cooter, *Unity in Tort, Contract, and Property: The Model of Precaution*, 73 CAL. L. REV. 1 (1985).

40. Tarlock, *supra* note 20, at 222.

41. *See, e.g.*, NAOMI ORESKES & ERIK M. CONWAY, MERCHANTS OF DOUBT: HOW A HANDFUL OF SCIENTISTS OBSCURED THE TRUTH ON ISSUES FROM TOBACCO SMOKE TO GLOBAL WARMING (2010).

42. Tarlock, *supra* note 20, at 236.

43. *Id.* at 237.

44. 42 U.S.C. §§ 4321–4335 (2012).

45. Tarlock, *supra* note 20, at 239–40.

Comprehensive rationality relies on the power of foresight to accurately predict the effects of actions.[46] Adaptation to climate change and other factors leading to new ranges of variation of environmental conditions and ecosystem phase changes will require a new legal process, even if mitigation reduces the long-term magnitude of the climate shifts.[47] Devising a better framework for environmental decision-making is therefore an essential task for environmental law scholarship.

II. WOULD RESILIENCE PROVIDE A USEFUL FRAMEWORK FOR ENVIRONMENTAL LAW?

Environmental law is one element in a system of governance, which is a process of setting goals and achieving them through social institutions. In part because of its defensive grasping for some core principle to claim, environmental law scholarship tends toward over-eager embrace of the latest trends. In the 1980s, sustainability (or, "sustainable development" in the international law context)[48] became a common theme of environmental reform proposals.[49] Sustainability is a helpful prompt for identifying overexploitation of resources before they crash and for intergenerational equity. But it is opaque when it comes to understanding sustainability of what. The very ambiguity that allowed sustainable development to be widely hailed—that it could be interpreted by different interests as sustaining their own needs—undermined its usefulness.[50] Sustaining business productivity, ecological services, and social goods all at once often proves an impossible balancing act.[51] Something has to give. In practice, the short-term exigencies of economic productivity

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46. *See generally* Bryan D. Jones, *Bounded Rationality*, 2 ANN. REV. POL. SCI. 297, 299 (1999) (describing comprehensive rationality); Charles E. Lindblom, *The Science of "Muddling Through,"* 19 PUB. ADMIN. REV. 79, 79–80 (1959) (attempts to manage public programs with comprehensive rationality generally fail); Charles E. Lindblom, *Still Muddling, Not Yet Through*, 39 PUB. ADMIN. REV. 517, 517–18 (1979) (updating and confirming his 1959 arguments).

47. J.B. Ruhl & James Salzman, *Climate Change Meets the Law of the Horse*, 62 DUKE L.J. 975, 1018 (2013).

48. WORLD COMM'N ON ENV'T & DEV., OUR COMMON FUTURE (1987) (commonly referred to as the "Brundtland Report" after the chair of the Commission, former Norwegian prime minister Gro Harlem Brundtland).

49. *See* Keith H. Hirokawa, *Saving Sustainability*, 46 Envtl. L. Rep. (Envtl. Law Inst.) 10,151 (2016).

50. Humby, *supra* note 3, at 86 (observing on Google's "Ngram Viewer" a clear trend in the decline of "sustainable development" relative to "resilience"). Professor Humby predicts that resilience could suffer the same fate if the term becomes "an empty signifier." *Id.* at 88. She echoes Professor Doremus's earlier warning that broad concepts can be used by agencies "as a ploy to placate demands for environmental protection without actually imposing any enforceable constraints on themselves." Holly Doremus, *Adaptive Management, the Endangered Species Act, and the Institutional Challenges of "New Age" Environmental Protection*, 41 WASHBURN L.J. 50, 53 (2001). Lynton Keith Caldwell memorably fretted that "sustainable development" risked becoming "a thought-stopping cliché." LYNTON KEITH CALDWELL, BETWEEN TWO WORLDS: SCIENCE, THE ENVIRONMENTAL MOVEMENT, AND POLICY CHOICE ix (1990).

51. *See* Newton & Freyfogle, *supra* note 2, at 26.

overshadow environmental and social aims.[52] The Trump Administration's objectives with respect to energy roughly translate to sustainability: that is, sustainability *of* current fossil fuel energy systems *to* growing social concern over the global injustice of climate change, *for* people who benefit from the industry and are largely insulated from its adverse impacts.[53]

Sustainability assumes both that we understand what can be sustained, and that we have the capacity to carry out what is necessary to maintain those conditions indefinitely.[54] But that assumption is not justifiable for the vast majority of social-ecological systems. A term associated with the "Ostrom School" of political science,[55] "social-ecological systems" (SES) encompasses the connected social, economic, and environmental relationships involved in such activities as farming or managing urban stormwater.[56] Professor Ostrom took the ecological resilience concept of Holling and extended it by observing the order in the relationship between and among the environment and the people who shape and use it.[57] She generalized the ecological principle to describe resilience as "the amount of disruption needed to transform a system from one stability domain (characterized by a configuration of mutually reinforcing processes and structures) to another."[58]

Social-ecological systems are complex. Rather than simplify them into sustained outputs, resilience recognizes that dynamic conditions (and our understanding of them) are relatively unpredictable.[59] Disruptive change can occur quickly and nonlinearly. The resilience of a system is the extent to which it can respond to stressors and retain its essential form.[60] When systems cross critical thresholds, then they transform into different phases.[61] A familiar example is a clear lake that absorbs nutrient inputs and purifies water. The lake's resilience describes the stock and flow

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52. *See, e.g.*, Rebecca M. Bratspies, *Sustainability: Can Law Meet the Challenge?*, 34 SUFFOLK TRANSNAT'L L. REV. 283, 297–98 (2011) (explaining how some approaches to sustainability merely justify existing development practices that degrade the environment).

53. *See* Michael C. Blumm & Olivier Jamin, *The Trump Public Lands Revolution: Redefining "The Public" in Public Land Law*, 48 ENVTL. L. 311, 348–66 (2018) (summarizing the Trump Administration "energy dominance" initiatives); *see also* Newton & Freyfogle, *supra* note 2, at 24–25 (emphasizing the importance of identifying who is doing the sustaining, for what end, and on behalf of which beneficiaries).

54. BENSON & CRAIG *supra* note 3, at 4; Melinda Harm Benson & Robin Kundis Craig, *The End of Sustainability*, 27 SOC'Y & NAT. RESOURCES 777, 779 (2014). Steve Carpenter, Brian Walker, J. Marty Anderies, and Nick Abel, *From Metaphor to Measurement: Resilience of What to What?*, 4 ECOSYSTEMS 765 (2001), point out that, like sustainability, resilience as a policy goal requires identification of what features are of interest (resilience of what) and which disturbances are of concern (to what).

55. ELINOR OSTROM AND THE BLOOMINGTON SCHOOL OF POLITICAL ECONOMY (Daniel Cole & Michael D. McGinnis eds., 2014–17).

56. *See* Elinor Ostrom & Marco A. Janssen, *Multi-Level Governance and Resilience of Social-Ecological Systems*, *in* GLOBALISATION, POVERTY AND CONFLICT 239 (Max Spoor ed., 2004).

57. *Id.*

58. *Id.* at 247.

59. *See* Holling, *supra* note 4, at 17.

60. *Id.*

61. *See* Ruhl, *supra* note 9, at 1377–78.

of nutrients it can absorb without flipping into a eutrophic phase dominated by algae. Once the lake transforms into a eutrophic state, it may no longer "bounce back" to reorganize into a clear lake even if the nutrient flows abate. Humpty Dumpty is not easily put back together. Social systems, such as banking, undergo similar resilient behavior—the subprime mortgage business hummed along steadily until it dramatically crashed into a completely different phase in 2008.[62] As complex as our economy or an ecosystem may be, the interactions between the two in a social-ecological system complicate the picture even more.

For instance, kelp forests are highly biologically diverse, structurally complex, and highly productive ecosystems that occur in mid-latitude, cold-water, rocky coastal waters.[63] When fishing depletes the population of top predators, herbivorous sea urchins may proliferate and eat enough kelp to crash the ecosystem and produce an entirely different ecological state.[64] This occurred along the U.S. Pacific Coast after sea otters largely disappeared. But, in the western North Atlantic, after the commercial fishing industry decimated predatory fishes, especially cod, large crabs thrived in the vacant niche and began reducing the urchin populations, keeping the kelp forests intact.[65] Such are the unpredictable, disparate outcomes of the coupled SES. And, these examples simplify phase changes because many SES have multiple equilibria, not just two states.[66]

A. The Social Dimension of Resilience

Despite the contingent uncertainty, we need an environmental law objective to recognize that humans always alter nature and are altered by it.[67] This is the essential insight of the Ostrom institutional analysis and development framework, which builds on the inevitable ecological context that shapes social institutions.[68] Resilience can guide answers to the questions of how much, where, and (with its social dimension) for whom. Sometimes sustainability and resilience objectives will correspond to the same procedures and outcomes. For instance, the recovery and maintenance of migratory waterfowl is among the greatest sustainability success stories of twentieth century America.[69] This management of bird populations and hunting within a consistent band of variation was accomplished with the tool of

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62. *See* Yuliya Demyanyk & Otto Van Hemert, *Understanding the Subprime Mortgage Crisis*, 24 REV. FIN. STUD. 1848 (2011).

63. Robert S. Steneck, Michael H. Graham, Bruce J. Bourque, Debbie Corbett, Jon M. Erlandson, James A. Estes & Mia J. Tegner, *Kelp Forest Ecosystems: Biodiversity, Stability, Resilience and Future*, 29 ENVTL. CONSERVATION 436, 436 (2002).

64. *Id.*

65. *Id.*

66. *See* Holling, *supra* note 4, at 19; C.S. Holling & Gary K. Meffe, *Command and Control and the Pathology of Natural Resource Management*, 10 CONSERVATION BIOLOGY 328, 328 (1996); Ostrom & Janssen, *supra* note 56, at 247.

67. Newton & Freyfogle, *supra* note 2, at 28.

68. McGinnis & Ostrom, *supra* note 36; Ostrom & Janssen, *supra* note 56.

69. Byron K. Williams, Mark D. Koneff & David A. Smith, *Evaluation of Waterfowl Conservation Under the North American Waterfowl Management Plan*, 63 J. WILDLIFE MGMT. 417, 419 (1999).

adaptive management.[70] But past success is no longer an indicator of the future. Prairie potholes of the upper Great Plains, important nesting habitats for a large proportion of migratory waterfowl, are drying up because the agricultural economy demands more drainage and because climatic change reduces available precipitation.[71] Wintering habitat south of the United States is disappearing under human population and economic pressures.[72] Signals that trigger seasonal migrations in many birds are no longer in sync with food sources, such as insect larvae emerging earlier in the spring, before the birds can arrive to eat them.[73] That also may affect the forests where more larvae consume more leaves. At the same time, in addition to the economic drivers of farming practices in the upper Great Plains and Latin America, migratory bird hunting has been declining in the United States over the past forty years.[74] That trend results in less habitat-conservation funding generated through mandatory "duck stamps" that the hunters must purchase and affix to their hunting licenses. Some North American bird migrations may well be an example of a social-ecological system nearing a resilience limit.

System resilience is not always good or bad from the point of view of social goals.[75] Most people would say that we should try to maintain North American bird migration in its current state by enhancing resilience to change through such practices as better water management in the upper Great Plains.[76] But, the organizing principle

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70. *See* James D. Nichols, Fred A. Johnson & Byron K. Williams, *Managing North American Waterfowl in the Face of Uncertainty*, 26 ANN. REV. ECOLOGY & SYSTEMATICS 177 (1995); James D. Nichols, Michael C. Runge, Fred A. Johnson & Byron K. Williams, *Adaptive Harvest Management of North American Waterfowl Populations: A Brief History and Future Prospects*, 148 J. ORNITHOLOGY S343 (2007).

71. Greg M. Forcey, Wayne E. Thogmartin, George M. Linz, William J. Bleier & Patrick C. McKann, *Land Use and Climate Influences on Waterbirds in the Prairie Potholes*, 38 J. BIOGEOGRAPHY 1694, 1695 (2011); W. Carter Johnson, Bruce V. Millett, Tagir Gilmanov, Richard A. Voldseth, Glenn R. Guntenspergen & David E. Naugle, *Vulnerability of Northern Prairie Wetlands to Climate Change*, 55 BIOSCIENCE 863, 863 (2005); Neal D. Niemuth, Kathleen K. Fleming & Ronald E. Reynolds, *Waterfowl Conservation in the US Prairie Pothole Region: Confronting the Complexities of Climate Change*, 9 PLOS ONE, no. 6, 2014, at 1. Climate-change effects are likely to rival land-use changes as the primary threats to vertebrate biodiversity over the coming century. Tim Newbold, *Future Effects of Climate and Land-Use Change on Terrestrial Vertebrate Community Diversity Under Different Scenarios*, 285 PROC. ROYAL SOC'Y B, no. 1881, 2018, at 1.

72. *See* DAVID S. WILCOVE, NO WAY HOME: THE DECLINE OF THE WORLD'S GREAT ANIMAL MIGRATIONS 30−32 (2008).

73. *Id.* at 44–46.

74. Paul Wait, *Looming Crisis: Falling Waterfowl Hunter Numbers Threaten the Future of Hunting and Conservation*, DELTA WATERFOWL, Spring 2017, at 44, 46, https://deltawaterfowl.org/wp-content/uploads/2017/03/LoomingCrisis.pdf [https://perma.cc/XNV6-CJTP]; *see also* Scott Yaich, *Ducks 2050*, DUCKS UNLIMITED, http://www.ducks.org/conservation/national/ducks-2050 [https://perma.cc/4BZ6-HSQJ] (projecting from current trends a decline in waterfowl hunters from 1.2 million in 2007 to 800,000 in 2050); U.S. FISH & WILDLIFE SERV., 2016 NATIONAL SURVEY OF FISHING, HUNTING AND WILDLIFE-ASSOCIATED RECREATION, 34, 117 tbl. C-4 (2018) (documenting waterfowl hunter numbers).

75. Benson & Craig, *supra* note 54, at 780.

76. *See, e.g.*, Forcey et al., *supra* note 71; Lisa G. Sorenson, Richard Goldberg, Terry L. Root & Michael G. Anderson, *Potential Effects of Global Warming on Waterfowl Populations*

of resilience may lead us to social choices that push other systems across phase-change boundaries. For resilience is not always associated with health or with an environment that functions in a way that benefits us. "Pathologically resilient" systems can trap management with institutions resistant to change but unable to withstand change.[77] The doomed Everglades provides one example where a resilient web of water governance institutions thwarts the kind of adaptive change necessary to maintain the unique ecosystem.[78] Yet, the traps of pathological resilience can yield to transformation. A legal objective may sometimes promote not the strengthening of resistance to change but instead an action to transform a system into another state.[79]

For instance, Pleasant Run is a twenty-seven mile-long waterway in Indianapolis that lost ecological functions over the past century of development.[80] Urban infrastructure and impermeable surfaces currently provide relatively few ecological and social services to relatively poor residents.[81] One legitimate way of thinking about a goal for the Pleasant Run SES is to nudge it into a new bounded-equilibrium state that better serves the people in the area and downstream. Indeed, one reason why funding is available for altering the system is that federal law mandates Indianapolis abate stormwater pollution and slow the ever-increasing surges of raw sewage runoff into the White River after even normal rainfall events.[82] Most debates about applying resilience as a legal objective arise in the preservationist context of enhancing resilience and keeping systems within the limits to avoid disruptive

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Breeding in the Northern Great Plains, 40 CLIMATIC CHANGE 343 (1998).

77. Melinda Harm Benson & Ahjond S. Garmestani, *Can We Manage for Resilience? The Integration of Resilience Thinking into Natural Resource Management in the United States*, 48 ENVTL. MGMT. 392, 394 (2011).

78. See Lance H. Gunderson, Ahjond Garmestani, Keith W. Rizzardi, J.B. Ruhl & Alfred Light, *Escaping a Rigidity Trap: Governance and Adaptive Capacity to Climate Change in the Everglades Social Ecological System*, 51 IDAHO L. REV. 127 (2014), for a discussion of how ecosystems and social institutions continued to change in interaction with each other in a manner that illustrated Holling's "rigidity trap." Holling, *supra* note 4.

79. Benson and Craig call this "intentional transformation." BENSON & CRAIG, *supra* note 3, at 67. On managing complex systems for resilience-related objectives, see generally PRINCIPLES FOR BUILDING RESILIENCE: SUSTAINING ECOSYSTEM SERVICES IN SOCIAL-ECOLOGICAL SYSTEMS (Reinette Biggs, Maja Schlüter & Michael L. Schoon eds., 2015); BRIAN WALKER & DAVID SALT, RESILIENCE PRACTICE: BUILDING CAPACITY TO ABSORB DISTURBANCE AND MAINTAIN FUNCTION (2012).

80. *Pleasant Run Stream Corridor Naturalization*, IND. U.-PURDUE U. CTR. FOR EARTH & EVNTL. SCI., https://cees.iupui.edu/restoration/pleasant-run [https://perma.cc/D8QH-6B5S].

81. *See* Simon Farrugia, Malcolm D. Hudson & Lindsay McCulloch, *An Evaluation of Flood Control and Urban Cooling Ecosystem Services Delivered by Urban Green Infrastructure*, 9 INT'L J. BIODIVERSITY SCI., ECOSYSTEM SERVS. & MGMT. 136 (2013) (discussing the effects of impermeable surfaces on local, riparian ecological and social service production).

82. *See* FRIENDS OF PLEASANT RUN, PLEASANT RUN WATERSHED MANAGEMENT PLAN 59 (2011), https://www.in.gov/idem/nps/files/wmp_pleasantrun.pdf [https://perma.cc/9JSN-JNGK]; INDIANA DEP'T. ENVTL. MGMT., PLEASANT RUN AND BEAN CREEK TMDL STUDY (2003), https://www.in.gov/idem/nps/files/tmdl_plrun.pdf [https://perma.cc/SBV7-TXHG].

transformation.[83] But Pleasant Run shows that resilience is equally helpful in framing a legal system that facilitates transformations to new conditions that better serve people. Cities will be the testing grounds for transformative management that aims to shift the role of waterways from hidden pipes or open sewers to community gathering grounds that provide a diversity of goods and services. To the extent compliance with the Clean Water Act motivates these urban watershed experiments in governance, it is an example of a static environmental law pushing for dynamic phase changes to SES.

Whether the socially constructed aim is enhancing resilience to resist regime change or pushing a system into a new phase, the process of environmental management is the same. This is an important point because, in practice, conservation often focuses solely on resisting the transformative effects of change even when transformation seems inevitable, such as in the context of the threat to coastal wetlands from sea level rise.[84] Equating resilience in environmental law with strengthening social-ecological systems by resisting phase changes is a blinkered misunderstanding of resilience as sustainability.[85] Instead, adaptive governance to promote transformation will become increasingly important, and not just in ill-functioning urban watersheds. Perhaps our greatest current environmental challenge is decarbonizing our energy systems. Resilient approaches to address the challenge, such as the "Deep Decarbonization Pathways Project,"[86] will employ law reform to drive a transformation in the social-ecological system of energy production and use.[87] Whether at the scale of a local watershed or a national energy system, transformative governance provides hope to people shut out of previous conceptions of environmental decision-making.

Emphasizing the notion that environmental law is for people—provisioning their wants and resolving their disputes—resilience of social-ecological systems steers us away from dualist notions of nature versus society that seldom help the environmentalist cause. For instance, Greg Siekaniec, Alaska regional director of the U.S. Fish and Wildlife Service, commented on the dispute over whether to drill for oil on the Arctic National Wildlife Refuge. He said that America's refuges are dedicated to "wildlife conservation over human use."[88] A resilience framework

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83. Benson & Garmestani, *supra* note 77, at 394.

84. Robert L. Fischman, Vicky J. Meretsky, Alexei Babko, Michael Kennedy, Lei Liu, Michelle Robinson & Susan Wambugu, *Planning for Adaptation to Climate Change: Lessons from the US National Wildlife Refuge System*, 64 BIOSCIENCE 993, 1001 (2014) (finding that, where refuge plans provided prescriptions to adapt to climate change, they overwhelmingly chose resistance strategies such as through shoreline hardening).

85. Benson & Garmestani, *supra* note 77, at 394.

86. DEEP DECARBONIZATION PATHWAYS PROJECT, http://deepdecarbonization.org [https://perma.cc/6D2L-TPUS].

87. Michael B. Gerrard, *Legal Pathways for a Massive Increase in Utility-Scale Renewable Generation Capacity*, 47 Envtl. L. Rep. (Envtl. Law Inst.) 10591 (2017).

88. Bob Reiss, *Bolstered by Trump, Big Oil Resumes Its 40-Year Quest to Drill in an Arctic Wildlife Refuge*, FORTUNE (Sept. 15, 2017), http://fortune.com/2017/09/15/Donald-trump-big-oil-alaska-arctic-wildlife-refuge [https://perma.cc/R3CN-LM75]. Congress subsequently mandated a program of oil and gas leasing in the Arctic National Wildlife Refuge as part of the Tax Cuts and Jobs Act of 2017, Pub. L. No. 115-97, § 11001, 131 Stat. 2054 (2017).

would consider wildlife conservation to be an objective *for* human use. The two are linked in a social-ecological system. Dualism sets up false choices.

Isolating the social from the ecological led the Idaho Supreme Court to deny federal reserved water rights for Deer Flat National Wildlife Refuge.[89] Federal public land law reserves to the United States implied water rights needed to avoid frustration of the primary purpose for creating the reserve.[90] President Franklin Roosevelt created Deer Flat Refuge to provide breeding and resting grounds for native birds on islands in the Snake River.[91] As part of Idaho's adjudication of water rights on the Snake, the supreme court rejected the United States' claim that the reservation required enough water to flow through the Snake by the islands, during bird breeding season, to ensure that nests remain isolated from the river banks.[92] Without those instream flow rights, irrigation upstream of the refuge sometimes lowers water flows so much that the refuge islands become peninsulas. The low flows subject nesting birds to predators. The Idaho court held that denying the water rights and allowing the land bridges to form between the islands and the river banks would not defeat the primary purpose of the refuge.[93] It justified its position by explaining that the president intended the refuge to benefit humans as the primary focus. The court wrote that it is "inconceivable that President Roosevelt . . . intended to give preference to waterfowl, or any other migratory bird, over people."[94] A more honest assessment of the decision is that it shifted the Snake River SES from serving *some* people who benefit from birds to *other* people who benefit from more irrigation diversions.

In severing conservation from benefits to people, the court misunderstood the role of wildlife in the environmental law. In a political competition between people and other animals, always bet on people. Resilience as an organizing principle of environmental law makes it easier to see how the two are inseparable. Hunters of caribou and waterfowl well south of the Arctic National Wildlife Refuge breeding grounds are part of that refuge's social-ecological system. So are birdwatchers and others who enjoy wildlife observation. And, we should not discount the role of the arctic systems in supporting agriculture itself, through the arctic breeding of birds that reduce crop loss by eating insect pests far from their summer range.

B. Managing Resilience through Adaptation

One reason that resilience works so well for environmental law is that it is not easily confused with an *outcome*, as is the case with sustainability. Properly understood, resilience is a *property* we need to work with, in pursuing our social vision.

> A resilience approach emphasizes combined strategies of enhancing *resistance* (e.g., survival and persistence), *recovery* (re-establishing the

89. United States v. State, 23 P.3d 117, 129 (Idaho 2001).

90. United States v. New Mexico, 438 U.S. 696, 699–700 (1978).

91. Exec. Order No. 7655, 2 Fed. Reg. 1453 (1937); Exec. Order No. 7691, 2 Fed. Reg. 1422 (1937).

92. *United States v. State*, 23 P.3d at 127.

93. *Id.* at 126–29.

94. *Id.* at 128–29.

> prior community following disturbance), and *reorganization* (allowing new suites of species to colonize an area that may be more adaptive under new conditions, and facilitating geographic migration of species). In this framework, new species moving into an area may be viewed [not simply as an invasive bad. It may instead reflect] an ecological response to climate pressure, and assisted migration techniques may be needed to conserve species whose climate envelope has shifted.[95]

Environmental law is fundamentally procedural rather than substantive.[96] It is a way of allocating rights and responsibilities, considering impacts (such as through NEPA),[97] setting goals (such as water quality standards),[98] managing harmful activities (such as air pollution emissions),[99] and translating land management objectives (such as healthy populations of wildlife) to particular contexts (such as a particular wildlife refuge).[100]

The process and systems view of environmental law is particularly important in addressing the epochal challenge of climate change. Without a coherent theory of environmental law, addressing climate change may deliver "emergent harms" resulting from uncoordinated approaches or neglect of how solutions redistribute social costs and benefits.[101] Reforming environmental law, therefore, will not be so different from creating environmental law. The birth of the modern era of federal environmental law can be fairly traced to Congress' 1969 enactment of NEPA.[102] The NEPA action-forcing mechanism of environmental impact analysis sought to integrate many different fields of study to provide a comprehensive understanding of all the consequences from a proposed course of action (and its alternatives).[103] Today, we need analyses that retain the social-ecological integration but provide more iterative adjustments than the front-loaded NEPA and the Administrative Procedure Act (APA) requirements.

Adaptive management fits that bill by treating actions or policies as experiments to test hypotheses about how the social-ecological system responds to human alterations.[104] The speed with which legal institutions and statutes integrate adaptive management will indicate the degree to which resilience emerges as a framework for environmental law. Adaptive management needs continual monitoring and flexibility

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95. Donald A. Falk, *The Resilience Dilemma: Incorporating Global Change into Ecosystem Policy and Management*, 48 ARIZ. ST. L.J. 145, 148 (2016).

96. Tarlock, *supra* note 20, at 220, 239.

97. 42 U.S.C. § 4332 (2012).

98. 33 U.S.C. § 1313 (2012).

99. 42 U.S.C. § 7410 (2012).

100. 16 U.S.C. § 668dd (2012).

101. Ruhl & Salzman, *supra* note 47, at 1019.

102. LAZARUS, *supra* note 16, at 67–68.

103. *See* 42 U.S.C. § 4332 (2012).

104. The term "adaptive management" typically refers to specific natural resources decision-making, such as annual catch limits for fisheries. The term "adaptive governance" refers to a similar iterative process, but more focused on broader issues associated with legal and policy reforms. Thomas Dietz, Elinor Ostrom & Paul C. Stern, *The Struggle to Govern the Commons*, 302 SCI. 1907, 1908 (2003).

to tinker with environmental management.[105] Those needs require legal reform. Adaptive management requires breathing space to allow learning to occur and actions to be altered in response to previous cycles of action.[106] Federal agencies have succeeded in undertaking adaptive management within the framework of NEPA, but it is an awkward fit with the comprehensive rationality of administrative law.[107] The next era of environmental law will require creation of iterative processes that provide the public input and analytical rigor of NEPA but that allow for more experimentation.[108] Adaptive management works best in highly resilient systems, which are more forgiving of misguided interventions seeking to preserve the ecological goods and services demanded by people.[109] A resilience framework for regulation of potentially harmful or polluting technologies may similarly adapt to unanticipated effects through *ex post* adjustments.[110]

Another challenge for implementing adaptive management in environmental law is to retain flexibility yet actually impose enforceable constraints on actions that affect resilience in an undesirable way.[111] Practitioners of adaptive management need new legal frameworks that force them to state measurable objectives for an action and to identify thresholds that will trigger specific responses to monitoring.[112] Otherwise, management may drift from its objectives. As Professor Camacho observes, "providing ad hoc, vague directives for experimental, collaborative regulatory processes invites delay and indecision to the detriment of those resources harmed by inaction."[113]

C. Resilience in Environmental Law Scholarship

The notion that resilience can fill the hollow soul of environmental law is increasingly popular in environmental law scholarship, though the amount of commentary is still relatively small. A Westlaw search of law journal articles containing the term "resilience" in a title yielded 114 publications as of December 31, 2017.[114] Of these, ninety-eight articles substantively grappled with some aspect

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105. Robert L. Fischman & J.B. Ruhl, *Judging Adaptive Management Practices of U.S. Agencies*, 30 CONSERVATION BIOLOGY 268, 269 (2015).

106. *Id.* at 270.

107. *See* J.B. Ruhl & Robert L. Fischman, *Adaptive Management in the Courts*, 95 MINN. L. REV. 425, 426 (2010).

108. *See* Robin Kundis Craig & J.B. Ruhl, *Designing Administrative Law for Adaptive Management*, 67 VAND. L. REV. 1 (2014).

109. Humby, *supra* note 3, at 94.

110. *See* Gary E. Marchant & Yvonne A. Stevens, *Resilience: A New Tool in the Risk Governance Toolbox for Emerging Technologies*, 51 U.C. DAVIS L. REV. 233, 247–51, 255–56 (2017).

111. Doremus, *supra* note 50, at 53; Fischman & Ruhl, *supra* note 105, at 272.

112. Fischman & Ruhl, *supra* note 105, at 272.

113. Alejandro Camacho, *Beyond Conjecture: Learning About Ecosystem Management from the Glen Canyon Dam Experiment*, 8 NEV. L.J. 942, 953 (2008).

114. Search of Westlaw for "TI(resilience)" for publication type "Law Reviews & Journals." The "TI" segment in Westlaw includes not only the actual text of the title but also the text of any footnote linked to the title. *E.g.*, Johan Colding & Carl Folke, *The Taboo System: Lessons About Informal Institutions for Nature Management*, 12 GEO. INT'L ENVTL.

of resilience. Since 2000, when the first article applying resilience to environmental law appeared,[115] resilience has become a popular term in many legal specialties. For instance, twelve articles applied the term in its psychological sense to mean the capacity to recover from harm and setbacks.[116] Other fields engage with resilience, but at lower frequencies: four articles applied resilience to financial regulation, four to cybersecurity and information law, and three to health care.[117]

No other subject matter of law journal articles comes close to environmental law in its depth of scholarly discussion of resilience. A narrow scope of articles about pollution control and resource management yields twenty-eight publications on resilience. Broadening the environmental law category to include urban planning, land use, infrastructure, disaster mitigation, and U.S. food security, yields fifty-two articles total.[118] After a lone analysis of informal institutions in 2000, no environmental law article indicated a focus on resilience in its title until 2007. Since then, all years but 2011 have seen publication of at least one environmental law article on resilience. Nonetheless, it is a trickle of scholarship, except for the three years when law reviews published symposia on the subject.[119] An article title search provides only a rough guide and surely undercounts articles dealing with resilience in environmental law. For instance, one of the contributions to a symposium on "Assessing Law, Resilience and Governance in Regional Socio-Ecological Water Systems Facing a Changing Climate" does not contain the word "resilience" in its title even though the article discusses resilience extensively in the context of

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L. REV. 413, 413 (2000) (footnote to title stating "This article is sponsored by the Resilience Network . . . .").

115. *Id.*

116. *E.g.*, Martha Albertson Fineman, *Vulnerability, Resilience, and LGBT Youth*, 23 TEMP. POL. & CIV. RTS. L. REV. 307, 320 (2014).

117. *E.g.*, Douglas W. Arner, *Adaptation and Resilience in Global Financial Regulation*, 89 N.C. L. REV. 1579 (2011) (financial regulation); Pierre de Vries, *The Resilience Principles: A Framework for New ICT Governance*, 9 J. TELECOMM. & HIGH TECH. L. 137 (2011) (information and communication law); Christina S. Ho, *In Defense of Circular Reasoning: The Affordable Care Act and the Resilience of Law and Self-Reference*, 5 WM. & MARY POL'Y REV. 1 (2013) (health care law).

118. *E.g.*, Meredith Hiller & Stephen J. Humes, *Resilience in the Utility Industry: Working Against the Rising Tides*, NAT. RESOURCES & ENV'T, Winter 2017, at 12 (infrastructure); Charles Lester & Mary Matella, *Managing the Coastal Squeeze: Resilience Planning for Shoreline Residential Development*, 36 STAN. ENVTL. L.J. 23 (2016) (planning); John R. Nolon, *Land Use and Climate Change Bubbles: Resilience, Retreat, and Due Diligence*, 39 WM. & MARY ENVTL. L. & POL'Y REV. 321 (2015) (land use); Nathalie N. Prescott, *Agroterrorism, Resilience, and Indoor Farming*, 23 ANIMAL L. 103 (2016) (food security); Anna K. Schwab & David J. Brower, *Increasing Resilience to Natural Hazards: Obstacles and Opportunities for Local Governments Under the Disaster Mitigation Act of 2000*, 38 Envtl. L. Rep. (Envtl. Law Inst.) 10,171 (disaster mitigation) (2008).

119. The three environmental law-related symposia are in volume 87 of the Nebraska Law Review (2009); volume 51 of the Idaho Law Review (2014); and volume 48 of Arizona State Law Journal (2016). *Natural Resources & Environmental Law Edition*, 51 IDAHO L. REV. 1 (2014); *Resilience & Environmental Law Reform Symposium*, 87 NEB. L. REV. 821 (2009); Symposium, *The Wildfire Menace*, 48 ARIZ. ST. L.J. 1 (2016).

governance and adaptive capacity to climate change in the Everglades.[120] Therefore, I did not count it in my rough survey.

Professor Humby conducted a literature review of a broader domain of scholarship that included Google Scholar.[121] Her larger sample provided a smoother picture of increased commentary over the past two decades. My review confirms her findings that the adaptability element of resilience is the most common focus of the legal literature.[122] Reliability, efficiency, scalability, or modularity elements of resilience[123] are commonly discussed in the legal literature, but not as consistently. It is fair to say that a new theme of resilience is emerging and enlivening environmental law scholarship. The next Part explores whether that scholarly trajectory can spur or parallel a rise in environmental law reform to better account for resilience.

III. CAN RESILIENCE MEET THE DEMANDS SOCIETY PLACES ON THE ENVIRONMENT?

The fallacy of naturalism cautions that observed attributes of nature are not necessarily ethical or suitable goals for humans.[124] In adopting a framework for setting environmental goals, we need to tread carefully and critically examine whether resilience serves the interests and morals of people. The major challenge to resilience as an organizing framework is that the legal fidelity to finality and security comes from real social demands. People like stability. People rely on the environment to provide the goods and services to which they have become accustomed. Adults delight when children experience the same parks and fishing streams that they recall from their youth. Lenders want assurances that their investments will be protected from environmental variability. Property owners cherish stability as a core value. How can we reconcile those—sometimes unrealistic—demands with the fluid adaptation of resilience?[125]

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120. *See* Gunderson et al., *supra* note 78.

121. *See* Humby, *supra* note 3.

122. *Id.* at 102.

123. Ruhl, *supra* note 9, at 1389–90 (relying in large part on David L. Alderson & John C. Doyle, *Contrasting Views of Complexity and Their Implications for Network-Centric Infrastructures*, 40 IEEE TRANSACTIONS ON SYS., MAN & CYBERNETICS 839, 840 (2010)).

124. *See, e.g.*, Newton & Freyfogle, *supra* note 2, at 28.

125. This question of reconciling legal goals with environmental management strategies is a key challenge for legal scholars. *See* Marchant & Stevens, *supra* note 110, at 251 ("[R]esilience involves a commitment to fluidity and malleability that may be contrary to the traditional legal purpose of ensuring stability and predictability.") (citing Barbara A. Cosens et al., *The Role of Law in Adaptive Governance*, 22 ECOLOGY & SOC'Y, no. 1, 2017, at 1 (explaining how "legal systems are also purposely structured to prefer the status quo by fostering stability and predictability" and that "[a]s a result of this stabilizing structure, legal systems may pose barriers to adaption")); John G. Sprankling, *Property Law for the Anthropocene Era*, 59 ARIZ. L. REV. 737 (2017).

A. Stasis and Change in the Environment

A hallmark of system resilience is the capacity to maintain a high level of consistency of behavioral structure in the face of a dynamic environment.[126] That is why it can be easy to confuse resilience with stability. But, some dynamic changes, inevitably, push systems over the line into new states that may produce very different goods and services. Resilience offers tools to help us grapple with changes in the variability of environmental conditions as former standards, such as historical benchmarks (e.g., 100-year floods), become unreliable. High variability and low predictability are probably the greatest challenges for maintaining resilience and adaptive capacity in environmental law.[127]

One response is that people must resign themselves to the fact that they can't always get what they want. Law simply cannot deliver certainty in our rapidly changing environment, now behaving outside of historical ranges of variation.[128] As Professors Benson and Craig explain, a resilience framework places people in a role "characterized by neither impotence nor omnipotence."[129] In other words, we need to manage for human objectives, but we cannot expect success at every turn. What was "natural," such as a particular flood frequency, or "native," such as a particular set of mosquito species, is no longer a reliable guide for management. Resilience, more than sustainability, reminds people that change cannot be halted and that change may arrive in sudden bursts, creating "a new abnormal."[130] Ecosystems may absorb more and more stress and continue to produce services—until they flip into a different state, perhaps in a short time frame.[131] Other environmental changes sound

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126. *See* J.B. Ruhl, *General Design Principles for Resilience and Adaptive Capacity in Legal Systems—With Applications to Climate Change Adaptation*, 89 N.C. L. REV. 1373, 1376 (2011).

127. *Id.* at 1393.

128. The authoritative report on climate change and the environment is U.N. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REPORT (2015). *See generally* P.C.D. Milly, Julio Betancourt, Malin Falkenmark, Robert M. Hirsch, Zbigniew W. Kundzewicz, Dennis P. Lettenmaier & Ronald J. Stouffer, *Stationarity is Dead: Whither Water Management?*, 319 SCI. 573 (2008) (explaining that current environment change now undermines the traditional assumption in resource management that natural systems fluctuate within an unchanging envelope of variability). More recent analyses raise the prospect that self-reinforcing feedbacks from current greenhouse-gas emissions could push the atmosphere across a transformation threshold into a "Hothouse Earth" equilibrium of much higher temperatures than projected by the 2014 Synthesis Report. Will Steffen et al., *Trajectories of the Earth System in the Anthropocene*, 115 PROC. NAT'L ACAD. SCI. 8252 (2018).

129. BENSON & CRAIG, *supra* note 3, at 48.

130. Alene Tchekmedyian, *Gov. Brown: Mega-Fires "The New Abnormal" for California*, L.A. TIMES (Nov. 11, 2018, 5:22 PM), http://www.latimes.com/local/california/la-me-california-fires-woolsey-hill-camp-gov-brown-mega-fires-the-new-1541985742-htmlstory.html#nt=card [https://perma.cc/Z5DJ-DFSF]. *See generally* NAT'L ACAD. OF SCI., DISASTER RESILIENCE: A NATIONAL IMPERATIVE (2012), http://nap.edu/13457 [https://perma.cc/P5ZK-43MU] (promoting a resilience approach to disaster recovery).

131. Unanticipated changes are not always adverse to human welfare. For instance, recent studies suggest that warming arctic temperatures may alter the behavior of spiders in such a

gradual, such as a 3mm/year rise in global sea levels.[132] A snail could outwalk that disaster! Virginia Beach and Miami Beach experience this consequence of greenhouse-gas emissions as a gradual worsening of high-tide flooding. But, climate change also increases the intensity of abrupt disasters where ordinary storms produce extraordinary flooding, due in part to the higher sea levels or warmer temperatures.[133]

Sustainability has a terrible record in fulfilling the promise of stability in such environmental goods as public land timber and marine fisheries.[134] Even before the effects of climate change were felt, ecologists of the 1970s came to realize that ecosystems were neither stable, persistent, nor predictable.[135] *Resilience will promise less but deliver more of what it promises*. One pitfall to avoid is the tendency to over promise, as sustainability often did over the past few decades. Still, resilience, like sustainability (or justice, for that matter) is a "malleable term" whose "popularity provides only a façade of consensus."[136] One danger of adopting resilience as a legal framework is it gives the impression, literally from its etymology, that it will ensure that systems "leap back" to their former state after shocks, without permanent rupture.[137] This is the common understanding of engineering resilience or

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way as to control greenhouse gas emitting fungi. Amanda M. Klotz, Aimée T. Classen & Justin P. Wright, *Warming Reverses Top-Down Effects of Predators on Belowground Ecosystem Function in Arctic Tundra*, 115 PROC. NAT'L ACAD. SCI. E7541 (2018).

132. Sönke Dangendorf, Marta Marcos, Guy Wöppelmann, Clinton P. Conrad, Thomas Frederikse & Riccardo Riva, *Reassessment of 20th Century Global Mean Sea Level Rise*, 114 PROC. NAT'L ACAD. SCI. 5946, 5946 (2017) (estimating a rise of 3.1 mm/year from 1993 to 2012, reflecting a substantial increase from the rate observed from 1901 to 1990). Three millimeters is approximately one tenth of an inch. Future rates of sea level rise will be even greater due to ever-increasing concentrations of greenhouse gases in the atmosphere. *See* Alexander Nauels, Joeri Rogelj, Carl-Friedrich Schleussner, Malte Meinshausen & Matthias Mengel, *Linking Sea Level Rise and Socioeconomic Indicators Under the Shared Socioeconomic Pathways*, 12 ENVTL. RES. LETTERS 114002 (2017).

133. *E.g.*, Kevin E. Trenberth, Lijing Cheng, Peter Jacobs, Yongxin Zhang & John Fasullo, *Hurricane Harvey Links to Ocean Heat Content and Climate Change Adaptation*, 6 EARTH'S FUTURE 730, 730, 735 (2018) (finding that Hurricane Harvey, which dumped a "record-shattering" sixty inches of rain in several locations, "could not have produced so much rain without human-induced climate change"); *see also* Kerry Emanuel, *Assessing the Present and Future Probability of Hurricane Harvey's Rainfall*, 114 PROC. NAT'L ACAD. SCI. 12681, 12681 (2017) (finding that the annual probability of a Harvey-sized rainfall increased from 1% during 1981−2000 to 6% in 2017).

134. *See* Lois H. Dellert, *Sustained Yield: Why Has It Failed to Achieve Sustainability?*, *in* THE WEALTH OF FORESTS: MARKETS, REGULATION, AND SUSTAINABLE FORESTRY 255 (Chris Tollefson ed., 1998) (illustrating how sustainable forestry failed in British Columbia); Michael C. Blumm, *Public Choice Theory and the Public Lands: Why "Multiple Use" Failed*, 18 HARV. ENVTL. L. REV. 405 (1994) (explaining the legal and political failures to achieve sustained yield of renewable resources on federal public lands); Josh Eagle, James N. Sanchirico & Barton H. Thompson, Jr., *Ocean Zoning and Spatial Access Privileges: Rewriting the Tragedy of the Regulated Ocean*, 17 N.Y.U. ENVTL. L.J. 646 (2008) (describing the failure of the United States regulatory regimes to prevent overfishing or rebuild stocks).

135. *E.g.*, Holling, *supra* note 4.

136. Newton & Freyfogle, *supra* note 2, at 23.

137. *Resilient*, SHORTER OXFORD ENGLISH DICTIONARY (5th ed. 2002).

robustness.[138] Ecological resilience, however, is simply the measure of how much alteration a system can absorb before losing its ability to recoil.[139] Resilience as an organizing principle can promise neither to resist change nor to sustain prior outputs from social-ecological systems.

Professors Victor Flatt and Rob Verchick have lamented the repeated use of the word "unprecedented" in press coverage of Hurricane Harvey without noting that Texas already experienced a 40% increase in intense rainfall from storms over the past century.[140] In other words, Harvey is the new (ab-)normal even if, strictly speaking, it lacks a historical precedent. Shortly after Harvey, Hurricane Irma roared into Florida, breaking apart three tower cranes that damaged property as they fell.[141] A decade ago, a state court overturned an attempt by Miami-Dade County to strengthen its regulation of cranes, which are currently designed to withstand winds up to 145 miles per hour.[142] The contractors for one of the buildings where Irma destroyed the cranes called the storm "unprecedented" in an effort to shrug off responsibility.[143] Yet, Irma is consistent with damage we now expect hurricanes to inflict on Florida.

There is some hope for law to consider softening its demand for stability. Over the long-term, even the common law shows a willingness to bend to new conditions. Many historians describe the nineteenth century shift in riparian water rights from a natural flow guarantee to socially contingent, reasonable use as an illustration of common law accommodating economic imperatives, such as the industrial revolution in a landscape transformed by hydropower mills, dams, and reservoirs.[144] Professor Smith has shown in a series of articles how common law can and does continue to

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138. *See* Forrest D. Fleischman, Kinga Boenning, Gustavo A. Garcia-Lopez, Sarah Mincey, Mikaela Schmitt-Harsh, Katrin Daedlow, Maria Claudia Lopez, Xavier Basurto, Burney Fischer & Elinor Ostrom, *Disturbance, Response, and Persistence in Self-Organized Forested Communities: Analysis of Robustness and Resilience in Five Communities in Southern Indiana*, 15 ECOLOGY & SOC'Y, no. 4, 2010. Engineering resilience is the property that allows a system to bounce back from disturbance and return to an equilibrium state. Isabelle M. Côté & Emily S. Darling, *Rethinking Ecosystem Resilience in the Face of Climate Change*, 8 PLOS BIOLOGY, no.7, 2010, at 1, 1; *see also* Ruhl, *supra* note 9, at 1386.

139. *See* Holling, *supra* note 4.

140. Victor B. Flatt & Rob Verchick, *Burying Our Head in Sand on Climate Change No Longer an Option*, HOUS. CHRON. (Sept. 28, 2017), https://www.houstonchronicle.com/opinion/outlook/article/Burying-our-head-in-sand-on-climate-change-no-12238961.php [https://perma.cc/J88U-F2LU].

141. Joel Rose, *Florida Crane Accidents Renew Safety Debate*, NPR (Sept. 13, 2017, 5:02 AM), http://www.npr.org/2017/09/13/550607370/irma-spotlights-dangers-of-construction-cranes [https://perma.cc/7U6J-G7NC].

142. *Id.*

143. *Id.* The fastest wind from Irma in Florida measured by the National Weather Service was 142 miles per hour, but between buildings wind tunnel effects can cause much higher gusts. *Hurricane Irma Recap*, WEATHER CHANNEL (Sept. 12, 2017, 8:00 AM), https://weather.com/storms/hurricane/news/hurricane-tropical-storm-irma-recap-2017 [https://perma.cc/GPY2-YVLD].

144. MORTON J. HORWITZ, THE TRANSFORMATION OF AMERICAN LAW 1780−1860, at 31 (1977); Morton J. Horwitz, *The Transformation in the Conception of Property in American Law, 1780−1860*, 40 U. CHI. L. REV. 248 (1973).

respond to many changes in social attitudes towards the environment, despite the dominance of statutes in the field.[145] In particular, Smith demonstrated that common law judges are able to contextualize aspects of the environment, such as trees, in order to determine when they add value to the landscape and when they may be a nuisance.[146] Through consideration of the socio-cultural context, a court can act as a counterweight to "inflexible environmental statutory directives" and protect the social value of stability at least as well as legislators.[147] Others have identified an evolutionary pattern to statutory environmental law that is not terribly different from the resilience of the common law.[148] Where and when resistance to phase changes in the social-ecological system is futile, resilient law can focus on steering a transition from one equilibrium state into another with the least possible system disruption.

Letting go of stability may benefit many people. Stasis is not an attractive social objective for those repressed by discrimination or poverty. The Indianapolis residents in the vicinity of Pleasant Run may prefer transformation because they see a more prosperous and equitable future under a different social-ecological regime. The possibility of transformation in a resilience framework may help expand the constituency for environmental law to new supporters who can envision how their lives would be improved through adaptive governance. But it does require opening the legal debates to new voices, a subject I will tackle in the next Part on whether law itself needs to be resilient.

One important shortcoming of resilience is that its systemic, stochastic approach fails to speak in a compelling way to most of the public. People have difficulty seeing the world as a chaotic, probabilistic system where causation is seldom direct. People respond more strongly to identified, particular individuals facing slight harm than to currently unknown, random people facing greater harm.[149] Oliver Wendell Holmes put the dilemma this way: "most people think dramatically not quantitatively."[150] We

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145. *See, e.g.*, George P. Smith, II & Griffin W. Fernandez, *The Price of Beauty: An Economic Approach to Aesthetic Nuisance*, 15 HARV. ENVTL. L. REV. 53 (1991). Professor Sprankling describes how property law can move from a static to a flexible, adaptive system in *Property Law for the Anthropocene Era*, *supra* note 125.

146. George P. Smith, II & David M. Steenburg, *Environmental Hedonism or, Securing the Environment Through the Common Law*, 40 WM. & MARY ENVTL. L. & POL'Y REV. 65, 111−12 (2015).

147. *Id.* at 112.

148. *See, e.g.*, E. Donald Elliott, Bruce A. Ackerman & John C. Millian, *Toward a Theory of Statutory Evolution: The Federalization of Environmental Law*, 1 J.L. ECON. & ORG. 313 (1985).

149. STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION 36−39 (1993). On the psychology of risk perception, see Paul Slovic, Baruch Fischhoff & Sarah Lichtenstein, *Cognitive Processes and Societal Risk Taking*, *in* THE PERCEPTION OF RISK (Paul Slovic ed., 2016) (ebook); Cass R. Sunstein, *On the Divergent American Reactions to Terrorism and Climate Change*, 107 COLUM. L. REV. 503, 522−23 (2007) (explaining the "affect heuristic" where people respond better to identifiable persons than to "deliberative or analytic assessment of the underlying issues").

150. Letter from Oliver Wendell Holmes, Jr. to Canon Patrick Augustine Sheehan (July 5, 1912), *in* HOLMES-SHEEHAN CORRESPONDENCE: LETTERS OF JUSTICE OLIVER WENDELL HOLMES AND CANON PATRICK AUGUSTINE SHEEHAN 63, 64 (David H. Burton ed., Fordham Univ. Press rev. ed. 1993) (quoted in BREYER, *supra* note 149, at 37).

can see the faces of the coal miners who may lose their jobs with a carbon tax. But there are far more yet-identified people who will die prematurely from asthma and other respiratory diseases caused by burning coal. How can law prompt the public to care? It can embrace the love that people feel for each other, for other animals, and for places, while articulating an inspiring vision.

On the conservation side of environmental law, advocates have long observed that emotion is an important—but often neglected—factor. Resilience seems too cold a term to inspire social change. Wendell Berry expressed the concern this way:

> We know enough of our own history by now to be aware that people exploit what they have merely concluded to be of value, but they defend what they love. To defend what we love we need a particularizing language, for we love what we particularly know.[151]

Affinity to place motivates environmental protection. The geographer Yi-Fu Tuan has called this "affective bond between people and place" topophilia.[152] Environmental law needs to find a better way to take more seriously this human yearning for connection.[153] Existing conservation programs that offer opportunities for people to unplug and engage with nature will need to expand if resilience is to serve as a foundational principle of environmental law.

Though enhancing resilience may increase the prospects for stability of systems, it cannot guarantee stasis. What most of us know are ordinary places. Ordinary components of the natural side of social-ecological systems play important roles in modulating phase changes.[154] Environmental law too often arrives late to a crisis, when problems are nearly insoluble. This is almost always the case with endangered species. The "not knowing what you've got until it's gone"[155] syndrome has hamstrung environmental law with too many objectives that set it up for failure. Greater focus on keeping the common abundant rather than simply trying to nurse depleted systems would be a beneficial turn for environmental law. Bird migrations are a good example of still-abundant ecological phenomena that can help sustain social-ecological systems. Rather than waiting until obligate migrants decline to the point of imperilment, taking steps early to secure the long-term future of migration would make a greater contribution to social well-being.[156] Similarly, concentrating area-wide preserves in places of monumental scenery, such as national parks, protects only a small global share of biodiversity. Yet, biodiversity is the redundant ecological element that maintains resilience. Biodiversity is doomed without

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151. WENDELL BERRY, LIFE IS A MIRACLE: AN ESSAY AGAINST MODERN SUPERSTITION 41 (2000).

152. YI-FU TUAN, TOPOPHILIA: A STUDY OF ENVIRONMENTAL PERCEPTIONS, ATTITUDES, AND VALUES 4 (1974).

153. Not all connections through affective bonding contribute to an inspiring vision. For instance, they may promote racial and religious segregation.

154. *See* Holly Doremus, *Biodiversity and the Challenge of Saving the Ordinary*, 38 IDAHO L. REV. 325 (2002).

155. JONI MITCHELL, *Big Yellow Taxi*, *on* LADIES OF THE CANYON (Reprise Records 1970).

156. *See* Robert L. Fischman & Jeffrey B. Hyman, *The Legal Challenge of Protecting Animal Migrations as Phenomena of Abundance*, 28 VA. ENVTL. L.J. 173 (2010).

ecological connections between park and wildlife reserves, across ordinary landscapes.[157] That is another reason why demonstration of best conservation practices in ordinary places is so important.[158] Moreover, the productivity of ecological services in ordinary places often far exceeds that of remote environments.[159]

One approach proposed for managing future environmental conditions that cannot sustain historically occurring ecosystems is to deliberately cultivate species and services we want.[160] Gardening nature is one way to embrace the Anthropocene.[161] Gardening the environment appeals to many Americans' almost religious sense of stewardship.[162] It connects care for the backyard with care for the planet. It also serves as an apt metaphor for many conservation innovations that will counteract the effects of climate change. But, history cautions that what we think we want, from channelized rivers to cheap food, may turn out in the end to do more harm than good.[163]

B. Stasis and Strict Legal Rules

Humans and our institutions act within systems that both shape and react to nature. The SES approach requires better understanding of this middle ground we occupy with respect to getting what we want from nature. The American wilderness ideal of conservation, with its vision of an unpeopled, untrammeled landscape, is almost unique in international environmental law.[164] Much to the chagrin of Native Americans, whose precolonial activities profoundly shaped the country encountered by European settlers, "getting back to nature" has too often required erasing human

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157. *See* Carl Folke, Steve Carpenter, Brian Walker, Marten Scheffer, Thomas Elmqvist, Lance Gunderson & C.S. Holling, *Regime Shifts, Resilience, and Biodiversity in Ecosystem Management*, 35 ANN. REV. ECOLOGY, EVOLUTION & SYSTEMATICS 557 (2004).

158. Vicky J. Meretsky, Robert L. Fischman, James R. Karr, Daniel M. Ashe, J. Michael Scott, Reed F. Noss & Richard L. Schroeder, *New Directions in Conservation for the National Wildlife Refuge System*, 56 BIOSCIENCE 135, 140 (2006).

159. James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607, 666 (2000) (citing, *e.g.*, Dennis M. King & Luke W. Herbert, *The Fungibility of Wetlands*, NAT'L WETLANDS NEWSL., Sept.-Oct. 1997, at 10) (in promoting functioning markets in wetlands mitigation banking, regulations tend to move wetlands-based ecological services from highly populated areas to more remote locations providing fewer ecological services to people).

160. *See* EMMA MARRIS, RAMBUNCTIOUS GARDEN: SAVING NATURE IN A POST-WILD WORLD (2011); Falk, *supra* note 95, at 148.

161. *See* Simon L. Lewis & Mark A. Maslin, *Defining the Anthropocene*, 519 NATURE 171 (2015).

162. *See* JOHN PASSMORE, MAN'S RESPONSIBILITY FOR NATURE (1974).

163. *See, e.g.*, David G. Guest, *"This Time for Sure"—A Political and Legal History of Water Control Projects in Lake Okeechobee and the Everglades*, 13 ST. THOMAS L. REV. 645 (2001) (describing the environmental problems that emerged from channelizing the Okeechobee watershed); Margot J. Pollans, *Drinking Water Protection and Agricultural Exceptionalism*, 77 OHIO ST. L.J. 1195, 1233 (2016) (discussing the inequitable environmental costs imposed by water pollution from cheap food production).

164. *See* RODERICK NASH, WILDERNESS AND THE AMERICAN MIND (1967).

history.[165] Yet, American wilderness preservation has succeeded, against all odds, in protecting and restoring cherished places. How it achieved that objective shines a light on the greatest weakness of resilience as an overarching goal of environmental law.

The Wilderness Act's limits on public land development,[166] the Endangered Species Act's (ESA) strict prohibitions on jeopardizing imperiled species,[167] and the Resource Conservation and Recovery Act's (RCRA) ban on open dumping[168] reflect some of the most effective laws because they reject the cost-benefit balancing so easily gamed and so often the slippery slope for incremental harms that undermine environmental protection. Strict prohibitions may fail to tailor management to local context. They appear unyielding and brittle—the antithesis of resilient. But, in practical terms, an implementing agency is far too weak to deny powerful economic interests their environmental resources without strict prohibitions. Critics assail the nonsense behind the vision of an unpeopled history,[169] the goal of zero discharge of pollutants to the nation's waters,[170] or the hubris of preventing all extinctions.[171] Yet, without those bright lines constraining behavior, which hardly map on to the continua of the environment, we would be living in a less resilient world unable to provide many of the services we enjoy. The ESA statutory trigger of jeopardy, for example, has been credited with signaling when key ecological thresholds of disruption may be crossed and prompting collaborative approaches to water governance.[172]

Lawyers who advocate for environmentalist organizations are among the greatest critics of law reform that would supplant inflexible, "prohibitive policy"[173] with softer limitations on private activities or broader discretion for public agencies. There may be no place on Earth untrammeled by humans. Some species cannot be rescued from extinction. Resilience scholars often push for more flexibility in statutes such as the ESA.[174] But to replace conceptually flawed yet practically powerful objectives with vague missions to garden ecosystems is a recipe for failure. Voluntary, polycentric[175] collaborative conservation is the gold (green?) standard for successful

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165. *See* William Cronon, *The Trouble with Wilderness: Or, Getting Back to the Wrong Nature*, 1 ENVTL. HIST. 7 (1996).

166. 16 U.S.C. § 1133(c) (2012).

167. 16 U.S.C. § 1536(a)(2) (2012).

168. 42 U.S.C. § 6924(c) (2012).

169. *See, e.g.*, Cronon, *supra* note 165.

170. *See, e.g.*, Lawrence S. Bazel, *The Clean Water Act at Thirty: A Failure After All These Years?*, 18 NAT. RESOURCES & ENV'T 46 (2003).

171. *See, e.g.*, CHARLES C. MANN & MARK L. PLUMMER, NOAH'S CHOICE: THE FUTURE OF ENDANGERED SPECIES (1995).

172. Barbara Cosens, Lance Gunderson & Brian Chaffin, *The Adaptive Water Governance Project: Assessing Law, Resilience and Governance in Regional Socio-Ecological Water Systems Facing a Changing Climate*, 51 IDAHO L. REV. 1, 27 (2014).

173. STEVEN LEWIS YAFFEE, PROHIBITIVE POLICY: IMPLEMENTING THE FEDERAL ENDANGERED SPECIES ACT (1982).

174. *E.g.*, Benson & Garmestani, *supra* note 77, at 395.

175. Polycentric order is "where many elements are capable of making mutual adjustments for ordering their relationships with one another within a general system of rules where each element acts with independence of other elements." Vincent Ostrom, *Polycentricity (Part 1)*, *in* POLYCENTRICITY AND LOCAL PUBLIC ECONOMIES 52, 57 (Michael D. McGinnis ed., 1999).

environmental management. But strict legal thresholds undergird such successes. The ESA, in particular, with its divine command to prevent extinctions, is a "regulatory driver" of about half of the hundreds of conservation collaborations studied by Professors Steven Yaffee and Julia Wondolleck.[176]

To declare enhancing resilience a goal and then provide agencies with the latitude to garden as they see fit is an approach at odds with history.[177] Enforceable standards for procedures and outcomes will continue to be necessary.[178] Public land law transformed in the 1970s in response to inadequate oversight and unmeasurable criteria for management.[179] Resilience will not work if it means turning back the clock on federal natural resources legislation. Pollution control law also transformed in the 1970s because insisting on a clear causative connection between a pollution source and an undesirable ecological or human health effect proved unworkable.[180] Such an approach is no more feasible today than it was in 1969.

The greatest promise for resilience is that it may incorporate our understanding of how social and environmental systems work together without discarding elements of law that have demonstrated their effectiveness.[181] There is no doubt that resilience-rooted environmental law rejects a vision of strict preservationism. Professor Tarlock and others warn that dynamic disequilibrium punctures the belief that we can either maintain current ecological systems as they are or recover the systems as they once existed.[182] Climate change and human movements have reshuffled the composition of ecosystems and are beginning to reshape the hydrologic, thermal, chemical, and biological drivers that create functioning ecological relationships.[183] Our postmodern

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176. JULIA M. WONDOLLECK & STEVEN L. YAFFEE, MAKING COLLABORATION WORK: LESSONS FROM INNOVATION IN NATURAL RESOURCE MANAGEMENT (2000) (describing more case studies); STEVEN L. YAFFEE, ALI F. PHILLIPS, IRENE C. FRENTZ, PAUL W. HARDY, SUSSANNE M. MALEKI & BARBARA E. THORPE, ECOSYSTEM MANAGEMENT IN THE UNITED STATES: AN ASSESSMENT OF CURRENT EXPERIENCE (1996); Steven L. Yaffee, *Collaborative Strategies for Managing Animal Migrations: Insights from the History of Ecosystem-Based Management*, 41 ENVTL. L. 655, 677 (2011).

177. Some argue that it is also at odds with environmental ethics. For that debate, see ROBERT ELLIOT, FAKING NATURE: THE ETHICS OF ENVIRONMENTAL RESTORATION (Andrew Brennan ed., 1997); ERIC KATZ, NATURE AS SUBJECT: HUMAN OBLIGATION AND NATURAL COMMUNITY (James P. Sterba ed., 1997).

178. Benson & Germestani, *supra* note 77, at 396; *see also* Humby, *supra* note 3, at 114−15; Bradley C. Karkkainen, *Adaptive Ecosystem Management and Regulatory Penalty Defaults: Toward a Bounded Pragmatism*, 87 MINN. L. REV. 943, 944 (2003) (arguing that "the absence of clear, legally enforceable, fixed procedural rules and substantive standards will translate into a kind of open-ended discretion likely to yield to unprincipled compromise, self-dealing, and a lack of accountability in basic governance processes").

179. *See* Robert L. Fischman, *The Divides of Environmental Law and the Problem of Harm in the Endangered Species Act*, 83 IND. L.J. 661, 671 (2008).

180. *Id.* at 674.

181. *See, e.g.*, ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 185−86 (1990) (highlighting the importance of monitoring and graduated enforcement for effective management of common resources).

182. Fred P. Bosselman & A. Dan Tarlock, *The Influence of Ecological Science on American Law: An Introduction*, 69 CHI.-KENT L. REV. 847 (1994).

183. *See* THE GREAT RESHUFFLING: HUMAN DIMENSIONS OF INVASIVE ALIEN SPECIES

dilemma is that we have no clear reference points anymore for what our environment should look like. But, a free-for-all approach to managing the environment will result in less rather than more of what we want from nature over the long run. Rejecting strict historic restoration or preservation only admits that nature won't cooperate with those goals. Resilience offers a guide for exploring what are reasonable demands to make of the environment.

Just as freshwater lakes may tip from clear to eutrophied, reef systems shift between coral domination and macro-algae domination.[184] Australia's Great Barrier Reef is the largest living structure on Earth.[185] About half the reef that existed in 1985 is now dead.[186] This is a system poised for a transformation to an entirely new phase of ecological composition and function.[187] But, marine scientists are making progress in selective breeding of coral that could result in planting some reefs with more heat-resistant organisms.[188] Such "assisted evolution" may stave off the transformation of reef ecosystems into something of less use or beauty to humans. But, where does gardening end? Should we replace lodgepole pine forests of the Rockies with more beetle-resistant trees? The Great Lakes fisheries with warmer water animals able to tolerate greater nutrient pollution? Puget Sound shellfish with cultivars better suited

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(Jeffrey A. McNeely ed., 2001); Jessica J. Hellmann, James E. Byers, Britta G. Bierwagen & Jeffrey S. Dukes, *Five Potential Consequences of Climate Change for Invasive Species*, 22 CONSERVATION BIOLOGY 534 (2008); Janneke HilleRisLambers, Melanie A. Harsh, Ailene K. Ettinger, Kevin R. Ford & Elinore J. Theobald, *How Will Biotic Interactions Influence Climate Change-Induced Range Shifts?*, 1297 ANNALS N.Y. ACAD. SCI. 112 (2013).

184. Sandra Zellmer & Lance Gunderson, *Why Resilience May Not Always Be a Good Thing: Lessons in Ecosystem Restoration from Glen Canyon and the Everglades*, 87 NEB. L. REV. 893, 897–98 (2009). Recent studies show that the proportion of blue, non-eutrophic lakes in the United States decreased by 18% between just 2007 and 2012. This reflects a rapid decline in water quality necessary for many human uses. Dina M. Leech, Amina I. Pollard, Stephanie G. Labou & Stephanie E. Hampton, *Fewer Blue Lakes and More Murky Lakes Across the Continental U.S.: Implications for Planktonic Food Webs*, LIMNOLOGY & OCEANOGRAPHY (Aug. 21, 2018), https://doi.org/10.1002/lno.10967 [https://perma.cc/B6VK-ERCN].

185. Daniel Cressey, *Future of Great Barrier Reef Divides Scientists*, 515 NATURE 16, 16 (2014).

186. *See* Damien Cave & Justin Gillis, *Building a Better Coral Reef*, N.Y. TIMES (Sept. 20, 2017), https://www.nytimes.com/2017/09/20/climate/coral-great-barrier-reef.html [https://perma.cc/W7HA-QZQH].

187. The authoritative surveys of the Australian Institute of Marine Science indicate that "the cumulative impacts of multiple, severe disturbances" over the past few years, including bleaching, cyclones, and starfish outbreaks, show steep declines of the Great Barrier Reef that have "not been observed in the historical record." AUSTL. INST. OF MARINE SCI., LONG-TERM REEF MONITORING PROGRAM – ANNUAL SUMMARY REPORT ON CORAL REEF CONDITION FOR 2017/18 (2018), https://www.aims.gov.au/reef-monitoring/gbr-condition-summary-2017-2018 [https://perma.cc/J4NM-YLTD].

188. *See, e.g.*, Rachel A. Levin, David J. Suggett, Matthew R. Nitschke, Madeleine J.H. van Oppen & Peter D. Steinberg, *Expanding the* Symbiodinium *(Dinophyceae, Suessiales) Toolkit Through Protoplast Technology*, 64 J. EUKARYOTIC MICROBIOLOGY 588 (2017) (cited in India Bourke, *CRISPR: Can Gene-Editing Help Nature Cope with Climate Change?*, NEWSTATESMAN (Oct. 5, 2017), https://www.newstatesman.com/culture/nature/2017/10/crispr-can-gene-editing-help-nature-cope-climate-change [https://perma.cc/QA6C-ZWM6]).

to its acidifying waters? For timber plantations and farm crops, the answers are clearly affirmative and consistent with the millennia of human experience with improving productivity.

Should environmental management be more like agricultural practices? Maybe, when it comes to retaining some iconic Joshua trees in Joshua Tree National Park.[189] The park area increasingly is too hot and dry to support the eponymous plants. Resisting the demise of the trees will require irrigation. Guiding the transformation of the ecosystem will require even more intensive management. In either event, though, a hands-off approach to let "nature take its course" is unlikely to achieve the goal of the national park unit.[190] The National Park Service long hewed to the hands-off approach, best articulated in the 1963 "Leopold Report" that recommended preserving park ecosystems in the condition "that prevailed when the area was first visited by the white man," as a "vignette of primitive America."[191] The Park Service responded to climate change and theories about ecological disequilibrium by emphasizing resilience when it revised the Leopold Report in 2012:

> The overarching goal . . . should be to steward . . . resources for continuous change that is not yet fully understood, in order to preserve ecological integrity and cultural and historical authenticity, provide visitors with transformative experiences, and form the core of a national conservation land- and seascape.[192]

This goal recognizes not only the disequilibrium of ecosystems, but also the potential for a phase change in the social dimension of resilience: "transformative experiences." It is a rare acknowledgement that people may have to fundamentally revise their expectations where nature itself cannot fulfill SES objectives. Transformative experiences include love of place, which may be necessary to motivate public support for resilient conservation.[193]

The National Park Service Director adopted the recommendation of the revised Leopold Report in a 2016 order that emphasized resilience in resource

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189. David N. Cole, Constance I. Millar & Nathan L. Stephenson, *Responding to Climate Change: A Toolbox of Management Strategies, in* BEYOND NATURALNESS: RETHINKING PARK AND WILDERNESS STEWARDSHIP IN AN ERA OF RAPID CHANGE 179, 184 (David N. Cole & Laurie Yung eds., 2010).

190. *See* David N. Cole et al., *Naturalness and Beyond: Protected Area Stewardship in an Era of Global Environmental Change*, 25 GEORGE WRIGHT F. 36, 37 (2008).

191. Advisory Bd. on Wildlife Mgmt., *Wildlife Management in the National Parks: The Leopold Report*, CRATER LAKE INST. (Mar. 4, 1963), http://www.craterlakeinstitute.com/online-library/leopold-report/complete.htm [https://perma.cc/QQ68-7AW6]. *See generally*, GARY E. MACHLIS & JONATHAN B. JARVIS, THE FUTURE OF CONSERVATION IN AMERICA: A CHART FOR ROUGH WATER 24–26 (2018) (describing the evolution of Park Service strategies to fulfill its conservation mission).

192. NAT'L PARK SYS. ADVISORY BD. SCI. COMM., REVISITING LEOPOLD: RESOURCE STEWARDSHIP IN THE NATIONAL PARKS 11 (2012).

193. *See supra* notes 151–152 and accompanying text; *e.g.*, TERRY TEMPEST WILLIAMS, THE HOUR OF LAND: A PERSONAL TOPOGRAPHY OF AMERICA'S NATIONAL PARKS (2016) (a memoir and travelogue combining love of family with love of parks).

management.[194] But the Trump Administration rescinded the order, presumably because of its assertion that the agency needed to respond to climate change.[195] Congress has begun to consider resilience enhancement as a way to resist disruptive environmental changes. In its massive Consolidated Appropriations Act of 2018, Congress created fast-track approval for "wildfire resilience projects" to promote retention of old-growth and large trees threatened by insects, disease, and crown fires.[196]

Gardening suggests a certain level of human mastery over the environment. While humans may certainly claim responsibility for profound alterations in the environment, our experience cautions against conflating that with mastery over the environment. The chaotic, stochastic nature of nature, resilience teaches, will upset our expectations in sudden and highly disruptive ways. Professors Craig and Benson go so far as to argue that we need new narratives to understand this resilient landscape. They look to the myths of the trickster creature, such as the coyote in many Native American cultures, to frame narratives that will increase the public's comfort with the realities of unwanted change.[197] Stability we crave, but it is exceedingly difficult to engineer in a complex, adaptive system. The greatest challenge for resilience as an environmental law objective is that it will not fulfill the expectation of sustaining what we like. But, it can guide us generally in a direction that can retain as much as we can under the circumstances.

Environmental governance is a continuum of practices in between the two extreme poles of preserving historical landscapes on one hand, and gardening entirely novel ecosystems on the other.[198] In fact, untamed, primeval nature has always been an ideal rather than a reality in environmental law. Gardening as a metaphor for incremental adjustments in response to management activities that also serve as adaptive experiments is well suited to describe the thematic aims of environmental law. Gardening as erasing the existing environment to create something entirely new is probably just as unrealistic and dangerous an approach as resisting environmental change up to the very point of futility. Environmental law has always comprised compromises. All of the strict prohibitions in the Wilderness Act, the Endangered Species Act, and the Clean Water Act may be waived by permits or exemptions.[199] Environmental law can accommodate pragmatic adjustments to

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194. National Park Service Director's Order #100: Resource Stewardship for the 21st Century §§ 1.1, 5 (Dec. 20, 2016) (rescinded Aug. 16, 2017), https://www.nps.gov/policy/dorders/do_100.htm [https://perma.cc/WCQ3-LW68].

195. Rob Hotakainen, *NPS Chief Scraps Climate-Focused Order*, E&E NEWS (Aug. 31, 2017), https://www.eenews.net/stories/1060059511 [https://perma.cc/KWD3-KTUV].

196. Consolidated Appropriations Act, 2018, Pub. L. No. 115-141, Div. O, Title II, § 202 (amending the Healthy Forests Restoration Act of 2003, codified at 16 U.S.C. § 6511 (2012)).

197. BENSON & CRAIG, *supra* note 3, at 50−56.

198. Anthony D. Barnosky et al., *Merging Paleobiology with Conservation Biology to Guide the Future of Terrestrial Ecosystems*, 355 SCI. 594, 594 (2017).

199. *E.g.*, 16 U.S.C. § 1133 (2012) (providing special exceptions to the prohibition on commercial enterprises and motorized equipment); 16 U.S.C. § 1536 (2012) (providing an exemption procedure for otherwise prohibited federal actions causing jeopardy to endangered species); 16 U.S.C. § 1539 (2012) (providing permits for otherwise prohibited incidental takes of endangered animals); 33 U.S.C. § 1342 (2012) (providing permits for otherwise prohibited

mitigate extreme disruptions without promising absolute resistance to change. But, how does resilience relate to the design principles for law reform itself?

IV. SHOULD ENVIRONMENTAL LAW ITSELF BE RESILIENT?

If the naturalistic fallacy is a danger in adopting an observed attribute of natural systems as an environmental objective, it is an even greater hazard when we turn to the question of legal design.[200] Earlier flirtations with applying natural science theory to law in the form of eugenics and social Darwinism raise cautionary flags.[201] Yet much of the non-legal literature on resilience neglects the problem of inflexible law completely reliant on uncertain predictions.[202] The social-ecological systems framework links the institutional concerns of law to the ecological concerns of natural resources management. Therefore, it is not possible to consider resilience objectives of environmental law without also reforming the adaptive capacity of law to promote resilient governance.[203] Many areas of statutory law, such as pollution control, operate under legislative charters that have scarcely changed in over a quarter century.[204] Still, federal environmental law already has adaptive qualities. This is especially evident in statutes that establish broad goals, standards, and procedures for engagement, yet leave specific application to the flexible response of states and agencies.[205]

Answering whether environmental law itself should be more resilient plunges us into the constitutive question of how institutions and procedures are structured.[206] In other words, how should we decide how to decide? Professor Clark argues that the answer is less about the substantive policy choices embedded in legislation or regulation.[207] Instead, it is more about who participates in making those choices, and how. These questions of justice and participation underlie environmental law reform challenges.[208] Ultimately, environmental law must establish a framework for

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discharges of pollution into waters of the United States).

200. *See* Elliott et al., *supra* note 148.

201. *See* Obergefell v. Hodges, 135 S. Ct. 2584, 2617 (2015) (Roberts, C.J., dissenting) (discussing the Court's experience with Lochner and constitutional social Darwinism); RICHARD HOFSTADTER, SOCIAL DARWINISM IN AMERICAN THOUGHT (rev. ed. 1955); VICTORIA F. NOURSE, IN RECKLESS HANDS: *SKINNER V. OKLAHOMA* AND THE NEAR TRIUMPH OF AMERICAN EUGENICS (2008).

202. Olivia Odom Green et al., *Barriers and Bridges to the Integration of Social-Ecological Resilience and Law*, 13 FRONTIERS ECOLOGY & ENV'T 332, 332 (2015).

203. *See* Ruhl, *supra* note 9, at 1382.

204. *See* LAZARUS, *supra* note 16, at 125–26.

205. *See* Daniel A. DeCaro, Brian C. Chaffin, Edella Schlager, Ahjond S. Garmestani & J. B. Ruhl, *Legal and Institutional Foundations of Adaptive Environmental Governance*, 22 ECOLOGY & SOC'Y, no. 1, 2017.

206. *See* Susan G. Clark & Marian E. Vernon, *Elk Management and Policy in Southern Greater Yellowstone: Assessing the Constitutive Process*, 50 POL'Y SCI. 295 (2017); *see also* Nick Abel et al., *Building Resilient Pathways to Transformation When "No One Is in Charge": Insights from Australia's Murray-Darling Basin*, 21 ECOLOGY & SOC'Y, no. 2, 2016.

207. Clark & Vernon, *supra* note 206.

208. *See* Jedediah Purdy, *The Long Environmental Justice Movement*, 44 ECOLOGY L.Q. 809 (2018).

collective governance. In other words, resilient law should give voice to people in an equitable manner. Resilience may sacrifice stability. But, it can deliver better distributional results by integrating the social with the ecological in systems analysis in environmental law.

Can a statutory system that is the vintage of the 8-track tape player properly adapt to new conditions? Proponents of a resilience framework often answer "no."[209] They argue that law itself needs to be resilient in order to promote experimentation and change in response. For instance, the Clean Air Act, last significantly amended in 1990, ignores the harms from greenhouse-gas emissions.[210] The EPA attempted to bend the Act's framework to better address the problem of climate change.[211] Instead of tailoring a rule to the statute, the EPA attempted to tailor a rule to social-ecological conditions.[212] The Supreme Court stopped the effort.[213] The EPA possesses some flexibility in implementing the Act, but not enough to adapt the statutory provision authorizing stationary source regulation to the mitigation challenge of reducing greenhouse-gas emissions.

Professor Ruhl characterized resilience in legal systems as providing consistency "notwithstanding continuous change of external and internal conditions."[214] My review of the law journal resilience literature indicates that about three-quarters of environmental/natural resources articles (twenty-one of twenty-eight) distinguish the role of resilience in setting environmental law objectives from its role in reforming law itself.[215] Most of the articles also address both issues head-on.[216] This should not be surprising in the law journals, which—after all—remain centrally engaged with legal analysis and reform.

Just as adaptive management promises to learn while doing and to reduce uncertainty through experimentation in achieving environmental goals,[217] adaptive governance approaches law as a contingent experiment subject to iterative fine-tuning.[218] A more resilient environmental law would be designed not as a fail-safe, static utopia. Instead, the emergent resilience property of social-ecological systems

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209. *See, e.g.*, BENSON & CRAIG, *supra* note 3, at 169–81; Ruhl, *supra* note 9.

210. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (1990) (codified at 42 U.S.C. §§ 7401–7671q).

211. Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 75 Fed. Reg. 31,513 (June 3, 2010) (codified at 40 C.F.R. pts. 51, 52, 70, 71) ("tailoring" the criteria of the Act's prevention of significant deterioration program to impose new permitting requirements for greenhouse-gas emissions for just the most significant stationary sources).

212. *See id.* at 31,517 to 31,518.

213. Utility Air Regulatory Group v. EPA, 134 S. Ct. 2427 (2014).

214. Ruhl, *supra* note 9, at 1379.

215. *E.g.*, Craig Anthony (Tony) Arnold & Lance H. Gunderson, *Adaptive Law and Resilience*, 43 Envtl. L. Rep. (Envtl. Law Inst.) 10,426, 10,428–29, 10,436–37 (May 2013).

216. *See, e.g.*, *id.*

217. *See supra* notes 104–13 and accompanying text.

218. *See* Alejandro E. Camacho, *Adapting Governance to Climate Change: Managing Uncertainty Through a Learning Infrastructure*, 59 EMORY L.J. 1 (2009); Alejandro E. Camacho, *Can Regulation Evolve? Lessons from a Study in Maladaptive Management*, 55 UCLA L. REV. 293 (2007); Justin R. Pidot, *Governance and Uncertainty*, 37 CARDOZO L. REV. 113 (2015).

demands a "safe-fail" approach that recognizes constant upheaval and adjustment.[219] Unlike systems resistant to change, safe-fail environmental law would encourage openness and experimentation in social institutions. Resilient law would mirror the bottom-up approach to managing the commons so closely associated with the Ostroms' Bloomington School.[220] We do need core principles and long-term planning, but with many iterative opportunities along the way to adjust to new conditions, better understandings, and changed social values.[221] Resilient law would provide avenues for citizens to express preferences and influence decisions. Much of that is squarely the province of procedural environmental law. Environmental law procedure can embrace resilience through mechanisms that generate knowledge and promote adaptive responses. Much can be done through administrative decisions, but the profound shift from stability to resilience will ultimately require statutory reform.

If Ambassador Bryce was correct that the national park system is "America's best idea,"[222] then NEPA's environmental impact analysis is America's most *copied* environmental law idea.[223] Both have their roots in the transcendental philosophy popularized by Emerson, Thoreau, and Muir, patriarchs of the environmental movement.[224] Thoreau, in particular, called for a morality of living "deliberately."[225] Fen Montaigne has characterized this as a system of "weighing the moral consequences of one's actions."[226] Resilience contributes a new framework for weighing these consequences. It informs rather than replaces the fundamental, jurisprudential core of environmental law: considering consequences. Environmental law frequently insists on consideration of impacts that may be far removed in place or time from their causes.[227] The legislative basis for environmental law is largely a

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219. Alicia Juarrero-Roqué, *Fail-Safe Versus Safe-Fail: Suggestions Toward an Evolutionary Model of Justice*, 69 TEX. L. REV. 1745, 1746 (1991).

220. ELINOR OSTROM AND THE BLOOMINGTON SCHOOL OF POLITICAL ECONOMY, *supra* note 55.

221. Holly Doremus, *Constitutive Law and Environmental Policy*, 22 STAN. ENVTL. L.J. 295 (2003).

222. The quotation is often attributed to Wallace Stegner; but, he credits British Ambassador to the United States, James Bryce, who gave a speech in 1912 to the American Civic Association in which he discussed national parks. WALLACE STEGNER, WHERE THE BLUEBIRD SINGS TO THE LEMONADE SPRINGS 128 (1992); Alan MacEachern, *Who Had "America's Best Idea"?*, NICHE (Oct. 23, 2011), http://niche-canada.org/2011/10/23/who-had-americas-best-idea [https://perma.cc/HB7S-WVQB].

223. Nicholas C. Yost, *Rio and the Road Beyond*, A.B.A. ENVTL. L., Summer 1992, at 1, 6 n.15 (citing more than eighty-two nations).

224. *See* STEPHEN FOX, JOHN MUIR AND HIS LEGACY: THE AMERICAN CONSERVATION MOVEMENT (1981); NASH, *supra* note 164; RODERICK FRAZIER NASH, THE RIGHTS OF NATURE: A HISTORY OF ENVIRONMENTAL ETHICS (Paul S. Boyer ed., 1989); DANIEL J. PHILIPPON, CONSERVING WORDS: HOW AMERICAN NATURE WRITERS SHAPED THE ENVIRONMENTAL MOVEMENT (2004).

225. HENRY DAVID THOREAU, WALDEN 118 (Princeton Univ. Press 1971) (1854).

226. Fen Montaigne, *American Surveyor*, N.Y. TIMES BOOK REV., July 23, 2017, at 17 (reviewing LAURA DASSOW WALLS, HENRY DAVID THOREAU: A LIFE (2017)).

227. *E.g.*, 40 C.F.R. § 1508.8(b) (2013) (requiring consideration of indirect effects, which are "later in time or farther removed in distance" in environmental impact analysis under NEPA); Protection of Visibility: Amendments to Requirements for State Plans, 82 Fed. Reg.

response to the literal "shortcomings" of common-law adjudication to canvass the indirect, synergistic, and remote effects of actions.[228] Legislation provided administrative institutions and procedures for scientific expertise to forecast effects beyond the scope of proximate cause. Environmental law promotes justice by relating a cold, calculating decision about energy efficiency in clothes driers to the effects of coal mining on people many hundreds of miles away who shoulder the loss of ecological services and other environmental harms many years into the future. The environmental justice movement is not so much a separate subfield of environmental law but a clear demand that environmental law live up to its ambitions of weighing moral consequences. The importance of environmental justice, which concerns the inequities in the distribution of environmental amenities and injuries, is to remind us of the core moral principle of law and extend it with deeper understanding.[229]

A resilient environmental law that includes the option of adaptive transformation of social-ecological systems requires changes to governance.[230] This means inviting new voices to the table. Environmental law, long confined to its own, specialized corridors of power, will be stretched thin to accommodate governance changes. Natural resources agencies, in particular, are generally comfortable with manipulating the ecological side of the social-ecological system. They are less willing to address the social dimensions because these elements are outside of their expertise and because their political power generally does not extend that far.[231] Therefore, resilient environmental law will need to be more attentive to social transformations. Very little legal analysis examines this aspect of resilient law and better consideration of social change must be a priority for future research. It holds promise to substantially increase the constituency of Americans who recognize how they benefit from environmental law.

Consideration of the full range of consequences is not merely a technocratic balancing of discounted and monetized costs versus benefits. It is a *moral* calculus as well. Parks are good not just because they create tourist revenue or improve public health. They are also good because they shape the moral character of generation after generation of people exposed to them. Professor Sagoff observed that, if we leave to future generations

> an environment that is fit for pigs, they will be like pigs; their tastes will adapt to their conditions as ours might when we move from the country into town. Suppose we destroyed all of our literary, artistic, and musical heritage . . . . We would then ensure a race of uncultured near illiterates. Now, suppose we leave an environment dominated by dumps, strip mines, and highways. Again, we will ensure that future individuals will be illiterate, although in another way. Surely, we should strive to make

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3078 (Jan. 10, 2017) (codified at 40 C.F.R. pts. 51, 52) (addressing regional haze caused by long-distant transport of pollutants).

228. *See* Fischman, *supra* note 179, at 674, 685.

229. *See* Jedediah Purdy, *Environmentalism for the Next Economy*, *in* LAW AND POLICY FOR A NEW ECONOMY 50 (Melissa K. Scanlan ed., 2017).

230. Matthew J. Colloff et al., *Transforming Conservation Science and Practice for a Postnormal World*, 31 CONSERVATION BIOLOGY 1008, 1010 (2017).

231. Benson & Garmestani, *supra* note 77, at 396.

> the human race better . . . . Surely, it is morally bad for us to deteriorate into a pack of yahoos who have lost both knowledge of and taste for the things that give value and meaning to life. Future generations might not complain: A pack of yahoos will *like* a junkyard environment. This is the problem. That kind of future is efficient. It may well be equitable. But it is tragic all the same. Our obligation to provide future individuals with an environment consistent with ideals we know to be good is an obligation not necessarily to those individuals but to the ideals themselves.[232]

Sagoff reminds us that moral consequences are not pure calculations but expression of our aspirations as a body politic. Former U.S. Fish and Wildlife Service Director Mollie Beattie summarized this view: "[w]hat a country chooses to save is what a country chooses to say about itself."[233] Shaping the world requires considerations of distributional justice to current generations and aspirations for the future. Kathryn Schulz claimed residents of the Pacific Northwest have not fully grappled with the potential for a catastrophic earthquake. She explained that the relative brevity of our lives breeds "temporal parochialism."[234] We have probably all heard about the NIMBY ("not in my back yard") who opposes certain environmental harms in his own neighborhood but raises no objections to similar developments elsewhere. As common is the NIMGY ("not in my generation's years") who resists difficult adjustments now (such as reducing greenhouse-gas emissions) but raises no objections to the harms that are then deferred to subsequent generations. One might characterize much of the Trump Administration's energy policies as temporally parochial in their reluctance to pay the price today for grave future injuries. The latency built into greenhouse-gas pollution raises particularly thorny moral issues.[235] The emissions of the past hundred years have largely locked future generations into a much longer period of hotter temperatures, more frequent deluges, longer droughts, higher sea levels, and more acidic waters.[236] Environmental law must grapple with whether that is the future we want for our progeny.

Another design principle suggested by resilience is related to polycentrism[237]: the ability of law to look across jurisdictional boundaries when necessary to follow

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232. MARK SAGOFF, THE ECONOMY OF THE EARTH: PHILOSOPHY, LAW, AND THE ENVIRONMENT 63 (1988).

233. U.S. Fish & Wildlife Serv., *A Look Back: Mollie Beattie*, NAT'L WILDLIFE REFUGE SYS. (last updated Oct. 15, 2015), https://www.fws.gov/refuges/about/conservationheroes/Mollie%20Beattie_07182012.html [https://perma.cc/BF7X-LYVJ].

234. Kathryn Schulz, *The Really Big One*, NEW YORKER (July 20, 2015), https://www.newyorker.com/magazine/2015/07/20/the-really-big-one [https://perma.cc/EE7B-JKNC]. Behavioral psychologists and economists describe this view as an availability heuristic or bounded rationality. *E.g.*, Daniel Kahneman, *Maps of Bounded Rationality: Psychology for Behavioral Economics*, 93 AM. ECON. REV. 1449 (2003).

235. *See* Daniel A. Farber, *From Here to Eternity: Environmental Law and Future Generations*, 2003 U. ILL. L. REV. 289; Jedediah Purdy, *Climate Change and the Limits of the Possible*, 18 DUKE ENVTL. L. & POL'Y F. 289, 294–95 (2008).

236. U.N. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 128.

237. Elinor Ostrom, *Beyond Markets and States: Polycentric Governance of Complex Economic Systems*, 100 AM. ECON. REV. 641 (2010).

consequences and ecological effects. The misfit between boundaries of nature reserves and the SES themselves is frequently cited in environmental law scholarship.[238] Case studies of how managers overcome boundary limitations contribute to our toolbox of strategies,[239] but law could do a better job incorporating greater flexibility. For instance, the U.S. Fish and Wildlife Service started facilitating landscape conservation designs, which are collaborative efforts to better coordinate what multiple but differently focused conservation stakeholders wish to accomplish on lands and in programs they control.[240] The Lower Wabash watershed in Illinois and Indiana has experienced dramatic habitat loss and nutrient pollution over the past century.[241] Its landscape conservation design could be a proving ground for reconstituting the on-the-ground "law of the land" in a manner less constrained by ownership and jurisdictional boundaries. But that will require sustained engagement by the federal government, which may yet revoke its support for this aspect of resilience in legal action.

Resilience can contribute to structural environmental law reform. In addition to the technocratic alterations necessary to promote adaptive management,[242] resilience should attend to the endogenous moral decisions about public actions or regulation. But it is not an end in and of itself. Instead, resilience is a catalyst for achieving the often implicit moral goals of environmental law.

CONCLUSION

Scholars will always debate how to best conceptualize environmental law. Every generation will consider new ways to understand the world and discard older frameworks that no longer map onto our aspirations or observations. Without the benefit of hindsight, it is difficult to predict whether resilience will endure as environmental law's framework for mediating between governance and a changing

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238. *See, e.g.*, Holly Doremus, *DOJ/ENRD Symposium on the Future of Environmental Law*, 47 Envtl. L. Rep. (Envtl. Law Inst.) 10,185, 10,198–99 (Mar. 2017).

239. *See, e.g.*, WONDOLLECK & YAFFEE, *supra* note 176; Joseph L. Sax & Robert B. Keiter, *The Realities of Regional Resource Management: Glacier National Park and Its Neighbors Revisited*, 33 ECOLOGY L.Q. 233 (2006).

240. Jocelyn L. Aycrigg et al., *Completing the System: Opportunities and Challenges for a National Habitat Conservation System*, 66 BIOSCIENCE 774, 775 (2016); Robert F. Baldwin, Stephen C. Trombulak, Paul B. Leonard, Reed F. Noss, Jodi A. Hilty, Hugh P. Possingham, Lynn Scarlett & Mark G. Anderson, *The Future of Landscape Conservation*, 68 BIOSCIENCE 60 (2018); Fischman et al., *supra* note 84, at 1001.

241. *See* U.S. ARMY CORPS OF ENG'RS & OHIO RIVER BASIN ALL., OHIO RIVER BASIN —FORMULATING CLIMATE CHANGE MITIGATION/ADAPTATION STRATEGIES THROUGH REGIONAL COLLABORATION WITH THE ORB ALLIANCE (2017); K.J. Van Meter, P. Van Cappellen & N.B. Basu, *Legacy Nitrogen May Prevent Achievement of Water Quality Goals in the Gulf of Mexico*, 360 SCI. 427 (2018); *Lower Wabash Landscape Conservation Design*, LANDSCAPE CONSERVATION COOPERATIVE NETWORK, https://lccnetwork.org/project/lower-wabash-landscape-conservation-design [https://perma.cc/NS8N-EGBD]; U.S. Dept. of the Interior, *Lower Wabash Landscape Conservation Design*, USGS (last updated Sept. 22, 2017), https://www.sciencebase.gov/catalog/item/56b378aae4b0cc79997fb065 [https://perma.cc/7GAX-K9MV].

242. *See supra* notes 104–18 and accompanying text.

world. Environmental law scholarship on resilience over the past decade has delivered important theoretical insights and extracted practical lessons from case studies. This Article is an attempt to distill that work and apply it to the fundamental questions of environmental law. Resilience and social-ecological systems frameworks have already exerted some influence over environmental law. Resilience modifies rather than replaces environmental law's core principle of precaution through process. Resilience is a property of our world. Nonetheless, it may serve as a management aim for systems performing in an optimal fashion. Resilience delivers better understanding of how caution operates in complex systems and provides procedural tools. It allows for adaptation through experience and relieves governance of the impossible task of ensuring all predictions are accurate before embarking on management or regulation. But the more radical challenges of resilience to environmental law are twofold.

First, resilience turns away from the futile search for certainty or finality in systems essentially characterized by high variability and low predictability. Environmental law often serves as our "law of the land" that translates ideas into on-the-ground practices. That translational function requires more candor and experimentation in all environmental decisions. Adaptive management requires softening our commitment to final agency actions and res judicata. Therefore, adaptive management poses tremendous challenges for the enforceable substantive standards so closely associated with the 1970s-era magisterial environmental statutes and judicial interpretations of administrative safeguards. Crude rules of thumb, such as bans on discharges without permits or prohibitions on jeopardizing endangered species, must continue to play some role because our knowledge will always fall short of understanding the full repercussions of actions in complex adaptive systems. Burdens of proof in common law and administrative settings need root-to-branch reassessment in light of the resilience framework. Conservation is restraint and thus conservative. But it is not sustainability and should not foreclose transformation. Resilient environmental law helps identify circumstances where stability is infeasible or undesirable.

Second, resilience as a management goal offers a framework for confronting the social drivers of unjust and inadequate outcomes of decades of environmental management that excluded some people. To live deliberately requires we contemplate distributive impacts as moral consequences. Environmental law must blaze paths for social change. Power structures must yield to fairer ways of provisioning social systems. During World War II, C.S. Lewis wrote that "[m]an's power over Nature turns out to be a power exercised by some men over other men with Nature as its instrument."[243] Only the environmental justice strand of environmental law has forthrightly dealt with this longstanding reality. With the echo of Elinor Ostrom whispering in our ears,[244] the legal response to environmental crises must address the social dimension to environmental management, and it must be experimental both spatially and temporally.

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243. C.S. LEWIS, THE ABOLITION OF MAN 28 (1944).

244. *See* Prize Lecture: Elinor Ostrom, *Beyond Markets and States: Polycentric Governance of Complex Economic Systems*, NOBEL PRIZE (Dec. 8, 2009), https://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2009/ostrom-lecture.html [https://perma.cc/2BMP-J2K5].